# ANNUAL AUTO ISSUE

# POPULAR SCIENCE

OCTOBER · 35c Monthly

LITTLE CHEVY 4

BUICK'S V-6

## New Engines

Plus
- The '62 Cars Inside and Out
- Details on the New Chevy II
- Driving Reports · Color Photos

Detroit's Answer on Car Safety

# FREE!

**340 PAGE LAFAYETTE RADIO ELECTRONICS CATALOG**

Lift This Flap

***Read all the details and Mail the Card below TODAY***

PLACE STAMP HERE

**LAFAYETTE RADIO**
**DEPT. KJ-1**
**P. O. Box 10**
**Syosset, L. I., N. Y.**

# YOURS FREE!

## THE NEW LAFAYETTE 1962 CATALOG 620

**Your complete "Electronics and Hi-Fi" Catalog featuring "The Best Buys in the Business." Available FREE, from Lafayette — America's Hi-Fi and Electronics Shopping Center**

***DETACH ALONG DOTTED LINE***

***FILL OUT AND MAIL THIS CARD FOR YOUR FREE LAFAYETTE***

**1962 CATALOG**

**LAFAYETTE RADIO**
**DEPT. KJ-1**
**P.O. BOX 10**
**SYOSSET, L. I., N. Y.**

☐ Send my **FREE** copy of Lafayette's 1962 Catalog 620

☐ Send me #....., shipping charges collect. I am enclosing $.....

Name.....

Address.....

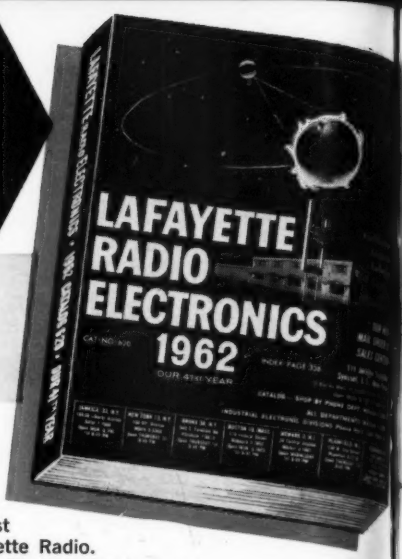
City..... Zone.....

State.....

**Detach and Mail *TODAY!***

**NO OBLIGATION**

# FREE!




## 340-PAGE

**1962 Lafayette Radio Electronics Catalog # 620**

*"America's Hi-Fi & Electronics Shopping Center"*

Yours free for the asking — the biggest, best and most comprehensive catalog in the 41-year history of Lafayette Radio. Audiophile, Experimenter, Hobbyist, Technician, Engineer, Student, Serviceman, Dealer — you'll find what you want in this latest Lafayette catalog.

TRANSISTORIZED PORTABLE TAPE RECORDER

RK-125__ 29.95

5" LOG LOG DUPLI DECIMAL TRIG SLIDE RULE

- Deluxe Pocket Size
- 24 Scales Including 8 Log Log Scales
- Leather Case with Pocket Clip

F-681__ 8.95

"EXPLOR-AIR" 4-BAND RECEIVER KIT

KT-135__ 21.95

**LARGEST STOCK SELECTION.** Stereophonic Hi-Fi equipment, Citizens Ham and Amateur equipment, Radio & TV parts, Optics, Industrial Su and much more, including all the favorite name brands.

**LAFAYETTE EXCLUSIVES.** Featured are the famous Lafayette K dollar for dollar the best value for your money today. You'll al hundreds of Lafayette specials... available only from Lafayette as always, **SATISFACTION GUARANTEED OR MONEY REFU**

**LOWEST PRICES.** You'll save money too with Lafayette's lo prices. The lowest prices are always in the Lafayette c

**24-HOUR SERVICE.** Quick, courteous service is your gua at Lafayette. Most orders are fully processed within 2 after receipt in the mail Order Division.

**NEW EASY-PAY PLA**
Now, **NO MONEY DOWN**...
up to 24 months to pa

10,000 OHMS-PER-VOLT MULTITESTER

TE-10__ 9.95

9-TRA
CITIZE
"WALKIE-T
HE-2
each
2 for

COMPLETELY WIRED, FULL SIZE TUBE TESTER

TE-15__ 19.95

4-TRANSISTOR PUSH-PULL AMPLIFIER

PK-543__ 4.95

## LAFAYETTE'S

**NEW MAIL ORDER HEADQUARTERS**
**111 JERICHO TURNPIKE**
**(2 Blocks West of South Oyster Bay Rd.)**
**SYOSSET, LONG ISLAND, NEW YORK**

120,000 Square Feet
Designed with You in Mind.

**Watch for Opening Fall, 1961**

The new, larger La Mail Order headquarters utilize newest methods and ment and skilled employees t you better and faster. The tho of satisfied Lafayette custome friends will benefit from service on an even wider var items at the same low price have made Lafayette famou world over.

**Detach and Mail the Attached Card for Your FREE CATA**

# FIRST TRUE "SHIRT POCKET" TWO WAY RADIO

5" high

## Spacephone

**SPACEPHONE** is a U.S. engineered and manufactured "walkie-talkie" which operates on a standard nine-volt transistor radio battery. It is the first transceiver which will actually fit in your shirt pocket. All-transistorized and crystal controlled, it embodies the latest techniques in subminiaturization. Spacephone is a masterpiece of design made with highest quality components and offering full range and excellent fidelity. Weighs 8 oz. Black satin finish. Solid brass, chromed antenna is included. Over 10,000 already sold to civilian and military users. Factory guaranteed, warranty included.

27 MC CITIZENS' BAND SPACEPHONE REQUIRES NO LICENSE, NO EXAMINATION, NO AGE LIMIT.

**$29.95** complete with battery each postpaid

TWO for $59.50

# FIRST INEXPENSIVE TRANSISTORIZED VOICE AMPLIFIER

## RANGERHORN

**SUPER RANGERHORN** replaces old style vacuum tube bullhorns and "loud hailers" costing from $60 to $200. It is a COMPLETE PUBLIC ADDRESS SYSTEM self contained with 1000 foot range. Super Rangerhorn, 10½" long, weighs 2½ lbs. contains a microphone, a loudspeaker, a transistorized electronic amplifier, a trigger-type switch and 6 standard photoflash batteries. Over 15,000 sold to boat-owners, scoutmasters, football and baseball coaches, rangers, construction companies and, apparently, to baseball and other sports fans who wish to offer their suggestions with greater volume. Factory guaranteed, warranty included.

**$19.95** each postpaid complete with batteries

U.S. designed and made. Factory guaranteed. These two new low-cost products were made possible by advanced circuitry developed by Electrosolids Corp. for satellite communications and are the result of a recent breakthrough in the field of solid state electronics.

**ELECTROSOLIDS CORP.**
Special Products Division
13745 Saticoy Street, Panorama City, Calif.

**ELECTROSOLIDS CORPORATION**
13745 Saticoy Street, Panorama City 55, Calif.

Gentlemen: Please ship the following via parcel post.

_____Spacephones at $29.95 ea. ($5 deposit per unit for C.O.D.)

_____Rangerhorns at $19.95 ea. ($2 deposit per unit for C.O.D.)

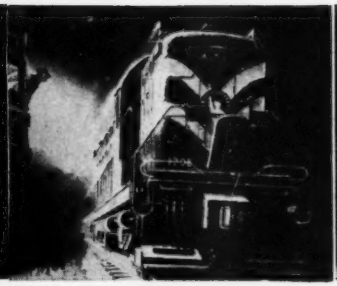
Name_____

Street & Number_____

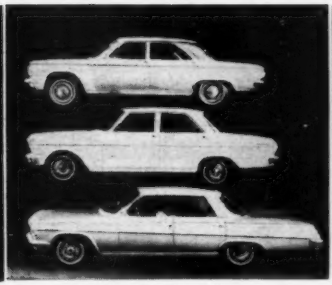
City_____ Zone____ State_____

California residents add 4% state sales tax.

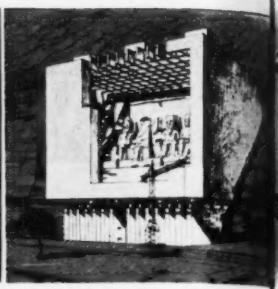
CONTENTS



**Ghost train:** *But who was at the throttle? P. 127*



**Chevy II:** *Twixt the big and the small. P. 68*



**Abu Simbel:** *Out of reach of the flood. P. 122*

*Founded in 1872 Vol. 179 No. 4* *Popular Science ®*

# Popular Science

***October, 1961***

**SPECIAL 30-PAGE AUTO SECTION**

**The '62 Cars Inside and Out**

***Full-Color Photos: New Engines . . . Styling . . . Ideas***


**Buick's Cast-Iron V-6 ..... 66**
**Chevy II's Four and Six ..... 68**
**The New Look on the Road .. 70**
**Bright Ideas in the New Cars 72**

**What's New Under the Hood ..... 74**
**What's New in Engineering ..... 78**
**Wringing Out Buick's V-6 ..... 82**
**What the '62s Are Like to Drive .. 85**
**Detroit Speaks Out on Safety ..... 89**


**SPECIAL FEATURES**


**A Robot with Sea Legs .....102**
**Raising Rameses' Temples .....122**

***Double-Length Feature of True Science Adventure:***

**"Runaway Engine on the Main Line!" .....127**

*Terror rode the rails the night Locomotive 1706 broke loose and thundered down the tracks out of control*


**CONSUMER NEWS**


**Saw Makes Logs into Boards .....100**
**What's New .....118**


**SCIENCE AND INDUSTRY**


**Electric Swap Under Channel ..... 98**
**Story of the GIs' Old Flame .....106**
**Collapsible Runabout .....112**
**Your Home's 90 Miles of Wire....114**



**Editor** HOWARD ALLAWAY **Managing Editor** FRANK ROWSOME JR. **Art Director** HOWARD C. JENSEN

**Assistant Managing Editors**
Kendall W. Goodwyn, Robert P. Stevenson

**Senior Editors**
Alden P. Armagnac, Devon Francis
Martin Mann, Everett H. Ortner

**Technical Editor**
Hubert Luckett

**West Coast Editor**
Wesley S. Griswold

**Associate Editors**
Frank Dorr, Sheldon M. Gallager
Herbert O. Johansen, Alfred W. Lees
Alex Markovich, Herbert R. Pfister
Joan Steen, Ruth Westphal

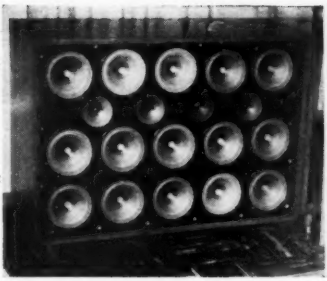
**Editorial Assistants**
Ross Lee Beeland (Chief), Anna Dallas
Phyllis Farber, Wanda H. Joseph
Georgette Sparks, Dorothy Zallen

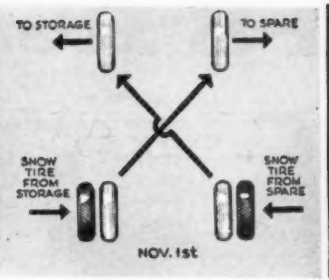
**Art Editors**
Herbert Anthony, Reginald A. Hawley
Harry Samuels

**Art Associates**
Eric A. Karminski Jr.
Henry W. Kazmirowski, Richard J. Meyer

**Photography**
W. W. Morris (Chief)
Robert D. Borst, Eugene Colangelo

EDITORIAL OFFICES: 355 Lexington Ave., New York 17, N. Y.






CONTENTS

**Shovels:** *The painless way to move earth. P. 138*

**Hi-Fi:** *Magnificent sound from $2 speakers? Here's how. P. 183*

**Tires:** *Cutest moneysaving switch of the year. P. 179*

*Mechanics and Handicraft* ®

# Monthly®

**America's NEW-IDEA MAGAZINE for 89 Years**

**FOR HOME AND SHOP**

The Right Shovel for the Job .....138
Materials File: Calking Compound .....143
*Save-It Section:* Catalogue of Clutches and Transmissions ....147
New Atlas-Clausing Drill Press ....162
Boating Hints .....164
Now . . . Cast Your Own Marble ..165
How to Make a Polishing Wheel..170
*Tear-Out Booklet:* How to Service Your Oil Burner .....174
Turning Snapshots into Slides ....180
Hi-Fi: The More the Mellower ....183

**AUTO UPKEEP**

Why Let Your Snow Tires Loaf?..179
Hints from the Model Garage .....192
Gus Pulls the Switch on Murder ..196

**SHORT CUTS AND TIPS**

A Moving Target for Archers .....145
Homemade Hone for Knives .....146
Covers for Window Wells .....159
Sander Sharpens Tools .....162
A Pointer for Slides .....163
Spillproof Dog Feeder .....169
Escape-Proof Bird Cage .....173
Safest Way to Clean Gutters .....182
Cradle Keeps the Record Clean ....187

**EVERY MONTH**

PS Readers Talk Back ..... 4
The Month in Science ..... 19
Detroit Report ..... 54
PS Puzzlers ..... 58
I'd Like to See Them Make .....104
New Ideas from the Inventors ....109
Wordless Workshop .....160

PUBLISHED MONTHLY by Popular Science Publishing Co., Inc., 355 Lexington Ave., New York 17, N. Y.

E. S. DUFFIELD
President and Publisher

JOHN R. WHITING
Executive Vice President

EUGENE WATSON
Vice President and Circulation Director

LEE P. ADAMS
Vice President and Advertising Director

SUBSCRIPTION SERVICE

***New or Renewal Orders:*** Send to Popular Science Subscription Department, 355 Lexington Ave., New York 17, N. Y. One year $3.40, 2 years $6, 3 years $8 in U.S., its possessions, and Canada. Elsewhere, 1 year $6, 2 years $11, 3 years $16. Single copy 35¢.

***All Subscription Adjustments:*** Write to John Walker, Popular Science, P.O. Box 2059, New York 17, N. Y. For change of address allow four weeks; please give *both old and new addresses*. Notices of undelivered copies (Form 3579) to Mr. Walker.

ADVERTISING OFFICES

NEW YORK—355 Lexington Ave.
CHICAGO—360 North Michigan Ave.
DETROIT—2810 Book Bldg.
SAN FRANCISCO—114 Sansome St.
CLEVELAND—636 B. F. Keith Bldg.
LOS ANGELES—711 South Vermont
PORTLAND, ORE.—520 S. W. Sixth Ave.

Second class postage paid at New York, N.Y., and at additional mailing offices. Entered as second class matter at the Post Office Department, Canada. Printed in U.S.A. Copyright © 1961 by Popular Science Publishing Co., Inc. All rights reserved.

# PS Readers

## TALK BACK

### Facts or Fallacies?

I AM deeply shocked at the generous space accorded Herman Kahn's manual for mass murder ["Facts and Fallacies of World War III," July]. His evil book has probably contributed more than any other to the doubts rampant in the world as to our national rationality.

Will you also please cease this periodic nonsense about Russia raising the water level by melting the polar ice just to spite us. Has it occurred to your Mr. Mann and his associates that the Russians have a coastline, too?

PROF. JOHN E. ULLMANN
Stevens Inst. of Tech.
Hoboken, N. J.

*The Russians have a very long coastline—with practically no cities on it. Raising the sea level would cripple us but merely annoy them.*

. . . HEARTY congratulations to you and your staff for printing the fine review of Kahn's *On Thermonuclear War*.

Those who refer to Kahn as "inhuman" and "obscene" for writing such a book display an unscientific stance in regard to one of our civilization's most disturbing problems. Evidently they prefer burying their heads in the sand to investigating the grotesque world situation as scientists.

May I suggest that Mr. Kahn write an article concerning the scientist's obligation to investigate openly the thermonuclear-war problem?

CHARLES W. COE, Hillsboro, N. M.

### He Was There

CONGRATULATIONS on "The Man Who Pinned Wings on the Navy" [July]. It is the best and most accurate story on Curtiss I have read, and I was with him at that time.

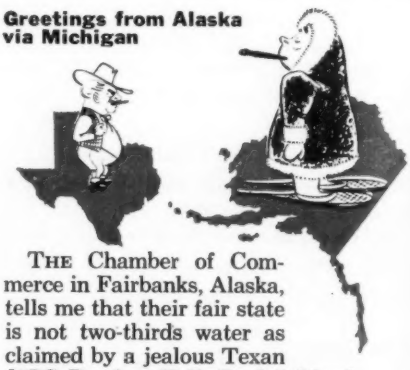
BECKWITH HAVENS, NYC.

### Tenting in Plastic

I READ with interest your article on lightweight-plastic tents ["How to Make a Tent for Five Bucks," June] because my son and I have been making shelters of this material for the past two seasons. We've settled on the Baker or Whelen design (with front canopy) for all-season usage when traveling light. For winter camping, we find that it helps to coat one side of the plastic with a light spray of aluminum enamel. This does an excellent job of reflecting heat from a campfire back into the tent.

R. E. STINSON, Mayfield, Mich.

### Greetings from Alaska via Michigan



THE Chamber of Commerce in Fairbanks, Alaska, tells me that their fair state is not two-thirds water as claimed by a jealous Texan ["PS Readers Talk Back," May].

It isn't even one-third water. Alaska is 586,400 square miles, or 2½ times the size of Texas. Thus, the land area is much larger than Texas. In addition, its coastline stretches 33,904 miles, exceeding all of the U. S. coasts combined. Fairbanks has spoken.

E. C. FUSER, St. Ignace, Mich.

### Gus Gets Some Competition

JUST read about checking a car's battery acid with a mirror ["Hints from the Model Garage," July] and thought some readers might like to know my method: Buy a ¼-inch glass feeding tube at any



CONTINUED

# BIG JOB BOOM FORECAST!

## *Can You Get Ready in Time?*

Right now job opportunities are tight all along the line. Economists now predict a period of mild ups and downs. Look for the "big break" to come in the next three years, they say. That's when good jobs will open up as never before. And men who are preparing themselves *now* will ride the crest of the boom.

### DARK OUTLOOK FOR UNSKILLED WORKERS

Those with little or no training will find the going tough. Fewer openings. More competition for existing jobs. The tide is against the unskilled worker. It's getting stronger. Nor will the boom help. The new opportunities will go first to the skilled, next to the semi-skilled.

### BIGGEST DEMAND IN THESE FIELDS

What's ahead? According to the best estimates, here are the industries due for the sharpest employment rise: Heavy transportation equipment. Mechanical, electrical, chemical, aeronautical and highway engineering. Industrial electronics. All metals. Business services. Natural gas and oil. Paper products. On the other end of the scale, employment may lag in agriculture and leather. Check the trends in *your* field. Are you prepared to switch, if necessary?

### GETTING YOURSELF READY—NOW

All the experts agree: Education, skill, specialized training will net the greatest rewards in the coming boom. The time you spend improving yourself is perhaps the wisest investment you can make *right now*. Your future success and happiness could hinge on your mastering a certain subject or acquiring a special skill. But there are obstacles. You may have a family to support. Or a job to hold down. You may feel you're too old to learn.

### HOW I.C.S. CAN HELP YOU

For the man who can take his training hard and fast—without time off from his job or heavy expense—I.C.S. offers real advantages. A total of 259 courses to choose from (see partial list below). A spare-time method that lets you progress as rapidly as you're able. Up-to-date, authoritative text material. Thorough, personalized instruction. Industry-recognized diploma to graduates. I.C.S. is the oldest and largest school accredited by the Accrediting Commission of the National Home Study Council. Its long list of successful graduates reads like "Who's Who."

Can you be ready for the next job boom? You can if you act quickly. Your first step: mark and mail the coupon below. What you do right this minute may determine how you make out in the coming boom!

**THREE FREE BOOKS TELL HOW TO MEET NEXT JOB BOOM**

Get the details on the fields that offer the best jobs in the immediate future. Get these three valuable books free—(1) "How to Succeed"—pocket-size guide to advancement, (2) Sample lesson (Math.) demonstrating the I.C.S. method, (3) Opportunity catalog on the subject you check in the coupon. Just mail the coupon.

**For Real Job Security—Get an I. C. S. Diploma!** **I. C. S., Scranton 15, Penna.** **Accredited Member, National Home Study Council**

## INTERNATIONAL CORRESPONDENCE SCHOOLS

ICS

**BOX 87085K, SCRANTON 15, PENNA.** (In Hawaii, reply P.O. Box 418, Honolulu) (Partial list of courses)

Without cost or obligation, send me "HOW to SUCCEED" and the opportunity booklet about the field BEFORE which I have marked X (plus sample lesson):

**ARCHITECTURE and BUILDING CONSTRUCTION**
- ☐ Air Conditioning
- ☐ Architecture
- ☐ Arch. Drawing and Designing
- ☐ Building Contractor
- ☐ Building Estimator
- ☐ Carpenter Builder
- ☐ Carpentry and Millwork
- ☐ Heating
- ☐ Painting Contractor
- ☐ Plumbing
- ☐ Reading Arch. Blueprints

**ART**
- ☐ Commercial Art
- ☐ Magazine Illus.
- ☐ Sign Painting and Design'g
- ☐ Sketching and Painting

**AUTOMOTIVE**
- ☐ Automobile
- ☐ Auto Body Rebuilding and Refinishing
- ☐ Auto Engine Tuneup
- ☐ Auto Electrical Technician
- ☐ Diesel Engines

**AVIATION**
- ☐ Aero-Engineering Technology
- ☐ Aviation Engine Mech.
- ☐ Reading Aircraft Blueprints

**BUSINESS**
- ☐ Accounting
- ☐ Advertising
- ☐ Bookkeeping and Cost Accounting
- ☐ Business Administration
- ☐ Business Management
- ☐ Clerk Typist
- ☐ Creative Salesmanship
- ☐ Managing a Small Business
- ☐ Professional Secretary
- ☐ Public Accounting
- ☐ Purchasing Agent
- ☐ Real Estate Salesmanship
- ☐ Salesmanship
- ☐ Salesmanship and Management
- ☐ Traffic Management

**CHEMICAL**
- ☐ Analytical Chemistry
- ☐ Chemical Engineering
- ☐ Chem. Lab. Technician
- ☐ General Chemistry
- ☐ Oil Field Technology
- ☐ Pulp and Paper Making

**CIVIL ENGINEERING**
- ☐ Civil Engineering
- ☐ Construction Engineering
- ☐ Highway Engineering
- ☐ Professional Engineer (Civil)
- ☐ Reading Struc. Blueprints
- ☐ Sanitary Engineer
- ☐ Sewage Plant Operator
- ☐ Structural Engineering
- ☐ Surveying and Mapping
- ☐ Water Works Operator

**DRAFTING**
- ☐ Aircraft Drafting
- ☐ Architectural Drafting
- ☐ Drafting & Machine Design
- ☐ Electrical Drafting
- ☐ Electrical Engineer Drafting
- ☐ Industrial Piping Drafting
- ☐ Mechanical Drafting
- ☐ Sheet Metal Drafting

**ELECTRICAL**
- ☐ Electrical Appliance Servicing
- ☐ Electrical Engineering
- ☐ Electric Motor Repairman
- ☐ Elec. Engr. Technician
- ☐ Elec. Light and Power
- ☐ Practical Electrician
- ☐ Practical Lineman
- ☐ Professional Engineer

**HIGH SCHOOL**
- ☐ Good English
- ☐ High School Diploma
- ☐ High School General
- ☐ H. S. College Prep. (Eng'r'g & Science)
- ☐ High School Math
- ☐ High School Science
- ☐ Short Story Writing

**LEADERSHIP**
- ☐ Industrial Foremanship
- ☐ Industrial Supervision
- ☐ Personnel-Labor Relations
- ☐ Supervision

**MECHANICAL and SHOP**
- ☐ Diesel Engines
- ☐ Gas-Elec. Welding
- ☐ Heating and Air Conditioning
- ☐ Industrial Engineering
- ☐ Industrial Instrumentation
- ☐ Industrial Safety
- ☐ Machine Shop Practice
- ☐ Mechanical Engineering
- ☐ Plumbing and Heating
- ☐ Professional Engineer
- ☐ Quality Control
- ☐ Reading Shop Blueprints
- ☐ Refrigeration and Air Conditioning
- ☐ Tool Design ☐ Tool Making

**RADIO, TELEVISION**
- ☐ General Electronics Tech.
- ☐ Industrial Electronics
- ☐ Practical Radio-TV Eng'r'g
- ☐ Radio-TV Servicing
- ☐ TV Technician

**RAILROAD**
- ☐ General Railroad

**STEAM and DIESEL POWER**
- ☐ Combustion Engineering
- ☐ Power Plant Engineer
- ☐ Stationary Diesel Engr.
- ☐ Stationary Steam Engines

**TEXTILE**
- ☐ General

Name_____ Age_____ Home Address_____

City_____ Zone_____ State_____ Working Hours_____ A.M. to P.M._____

Occupation_____

Canadian residents send coupon to International Correspondence Schools, Canadian, Ltd., Montreal, Canada. . . . Special low monthly tuition rates to members of the U. S. Armed Forces.

drug store and cut off about five inches. Put the tube in the cell until it hits the plates, place your thumb over the open end of the tube and remove the tube from the cell. The height of acid in the tube will show how much acid you have over the plates. Remove your thumb from the tube and let the acid drain back into the cell.

F. B. SKINNER, Portland, Ore.

. . . YOUR method of checking valve and clutch springs for proper strength ["Hints from the Model Garage," July] is unnecessarily complicated. By just setting a bathroom scale on a drill-press table and compressing the spring with the spindle, you can eliminate any calculations. If no drill press is available, any positive leverage will do.

M. L. LALIBERTE, San Diego.

**Have You Seen This Man?**

SINCE POPULAR SCIENCE has many readers in the garage and service-station business, perhaps you can help the FBI locate a fugitive who is known to be a skilled mechanic. Most recently he was the owner of a garage that specialized in the repair of automatic transmissions.

James Marvin Tuttle (also known as "Tut") is charged with unlawfully fleeing, about July 31, 1960, from Orange County, Calif., to Detroit, Mich., to avoid prosecution for rape.

Tuttle is 37 years old, white, 5 feet 1 or 2 inches tall, weighs 130 pounds, has blue eyes and light brown hair. He has scars on both cheeks and at base of nose. Walks with limp; may wear built-up left shoe. He reportedly carries an automatic pistol in pocket or car and should be considered armed and dangerous.

Anyone having information concerning his whereabouts, please contact your local FBI office.

H. G. FOSTER, Special Agent in Charge, FBI, NYC.

**Did Chiropractors Get There First?**

"YOU, Too, May Revive the Dead" ["The Month in Science," July] speaks of external heart massage as a new tech-

CONTINUED

FOR LONG WEAR IN SERVICE SHOES

SEARS ROEBUCK AND CO.

GET SEARS Gold Bond® CUSHIONED OXFORDS WITH NEOPRENE SOLES!

ORDER
No. 4557—Brown
No. 4558—Black
Sizes from 6 to 14, widths B to EE

There are two good reasons for buying Sears Gold Bond Service Oxfords. One is Foot Comfort. These handsome shoes, with heel-to-toe air cushion insoles, guard against foot fatigue all day long... give you comfort that's like "walking on air."

The other is Long Service. Gold Bond Oxfords are designed for men whose work is tough on shoes. Neoprene soles and heels are rugged, resilient and long wearing . . . resist oil, grease, chemicals and cold weather cracking.

See them at your Sears, Roebuck and Co. retail store or catalog office, or shop at home through the big Sears catalog.

DU PONT

BETTER THINGS FOR BETTER LIVING ... THROUGH CHEMISTRY

# THIS FREE SAMPLE LESSON

*will prove that you can become an expert*

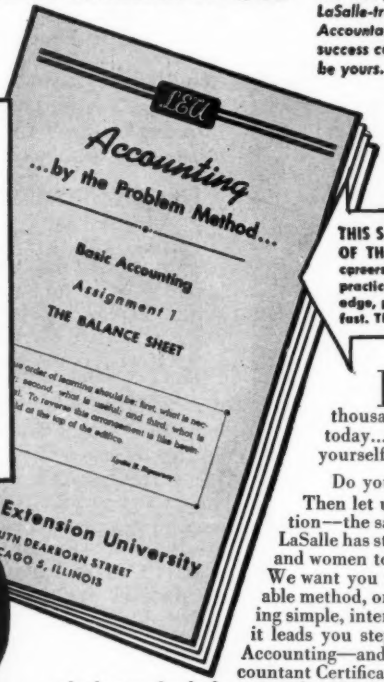
# ACCOUNTANT...AUDITOR OR CPA

*This well-paid LaSalle-trained Accountant's success could be yours.*

**FREE SAMPLE LESSON**

**We offer you this free sample lesson so that you can *prove to yourself* that you CAN master Accounting—quickly, thoroughly—in spare time at home.**

**You will see exactly how LaSalle's famous "Problem Method" works...how you are led step-by-step through actual accounting work—*learning by doing* and not by study of theory alone. First you tackle easy problems, then more difficult ones—until soon you master them all. And at every step you have the close personal guidance of LaSalle's large staff of expert accountants and CPA instructors.**




**THIS SAME LESSON HAS STARTED HUNDREDS OF THOUSANDS toward well-paid accounting careers—in business, government, and public practice as CPAs. Even without previous knowledge, progress is rapid—earning power climbs fast. This sample lesson will show you why.**

One out of every 13 of all CPAs in the U.S. has been trained by the LaSalle Problem Method

IF you have been envying the high incomes and good jobs enjoyed by thousands of men and women Accountants today...why not launch such a career for yourself?

Do you doubt that you can?

Then let us send you—without cost or obligation—the same Lesson Number One with which LaSalle has started several hundred thousand men and women toward successful accounting careers. We want you to see for yourself how this remarkable method, originated by LaSalle, makes Accounting simple, interesting, practical, and certain...how it leads you step-by-step to a complete mastery of Accounting—and on up to the Certified Public Accountant Certificate if you so aspire. It doesn't matter whether you've had previous bookkeeping experience, or whether you don't know a debit from a credit. Whether you wish to qualify as an expert accountant, advanced accountant, cost accountant, auditor, government accountant, income tax specialist, or public accountant...you'll find in LaSalle's Problem Method the exact plan to prepare you rapidly and inexpensively—in spare hours at home—without losing a day from your present job.

So right now, today...if you are an adult, employed, and earnestly ambitious for rapid advancement in one of the highest paying fields of business... send your name and address on the coupon below. We'll send you the free sample lesson—plus our illustrated book outlining today's career opportunities and how you can qualify for them. A coupon like this has started many thousands toward greater success. It can do the same for you. Mail it today!

***Accredited Member, National Home Study Council***

## GOOD-PAY JOBS IN MANY FIELDS

If you were an expert accountant right now, chances are you would find yourself in one of the best paid fields of business.

There are several big fields of opportunity open to men and women trained in accounting...opportunities that are wide open and highly inviting, offering maximum income and job security in good times or bad. And under LaSalle's "Problem Method" you can start earning while still learning—either in spare-time or full-time employment...or in business for yourself with no capital required.

Get the latest information by sending for our illustrated booklet, "Opportunities in Accounting"—plus free sample lesson. The coupon at right will bring both to you without cost or obligation. LaSalle Extension University, 417 S. Dearborn St., Chicago 5, Illinois.

**Clip Coupon . . . Mail TODAY!**

**LaSalle Extension University . . . *A Correspondence Institution***

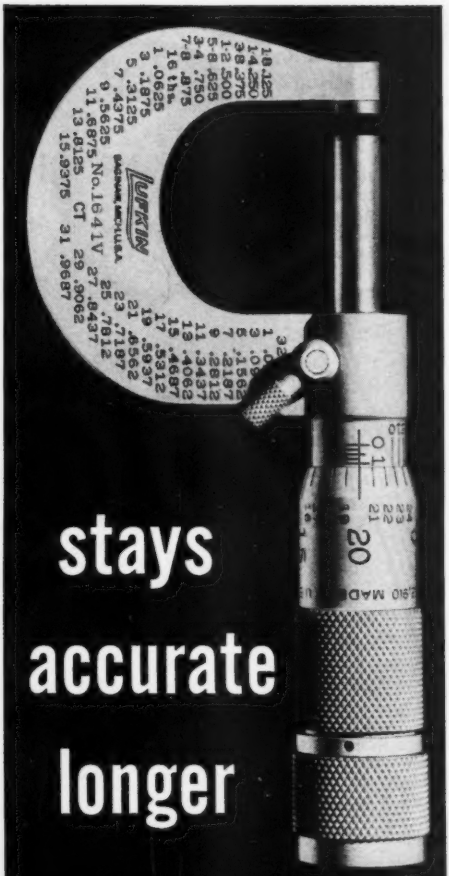
**Dept. 1083H, 417 S. Dearborn Street, Chicago 5, Illinois**

YES, I want to see how LaSalle's "Problem Method" works... Send me free sample lesson—also your book, "Opportunities in Accounting"...without cost or obligation.

*Name*.....*Age*.....

*Street Address*.....

*City, Zone & State*.....


stays
accurate
longer
LUFKIN
SAGINAW, MICHIGAN
No.164 1V
CT 29 .9062
31 .9687
A LUFKIN EXCLUSIVE: 5 to 7 fewer parts than other micrometers . . . less to get out of adjustment! One-piece frame and hub simplifies wear adjustment, assures greater accuracy. Exclusive cam lock prevents reading errors. Ratchet stop top. Easy-to-read markings on nonglare Chrome Clad® finish.
Leading Industrial Distributors feature Lufkin – the new leader in precision tools.
LUFKIN
SAGINAW, MICHIGAN

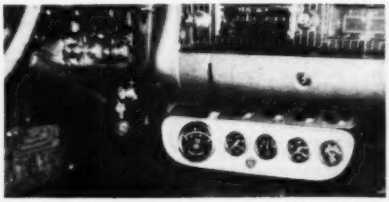
nique. This is not so. Nor did Drs. Jude, Kouwenhoven, and Knickerbocker discover it.

I was taught this technique eight years ago by Dr. Frank E. Dean of the Columbia College of Chiropractic, Baltimore, Md. A number of colleagues with whom I graduated will be happy to validate this statement.

THOMAS J. GOUGH, D. C., NYC.

**Gauging Performance**

AFTER reading "Let's Bring Back the Missing Gauges" [July], I took this picture of the dashboard in my '56 Cadillac.



I've installed a tachometer, an engine oil-pressure gauge, an ammeter, a Hydra-Matic oil-pressure gauge (marked "full pressure" because that's all I could get that was good for 200 pounds' pressure), and an engine-vacuum gauge. The panel itself is a Corvair glove-compartment door. This is admirably suited for the purpose as it is flat, sturdy, and completely finished.

With mechanical pressure gauges, it is necessary to have a nonmetallic connection in the line. Otherwise, noise transmitted through the copper tubing to the instrument panel is quite annoying. I use a short oil-filter hose for engine oil pressure, and a power-steering control-valve hose for the transmission.

S. E. MILLER JR., Tarrytown, N. Y.

**No Mistake**

I'VE been hoping to try your formula for "Restoring Brightness to Coated Metals" [July]. So far, I've talked to three druggists and two chemists and the consensus is that an error was made in specifying aniline. They seem to think that somewhere along the line the word anAline was misspelled. Please advise.

S. A. VATTER, Grand Rapids.

*Aniline is the correct name and the name most commonly used by chemists. The chemical formula is $C_6H_5NH_2$ and*



CONTINUED

# 50% MORE TIRE MILES?

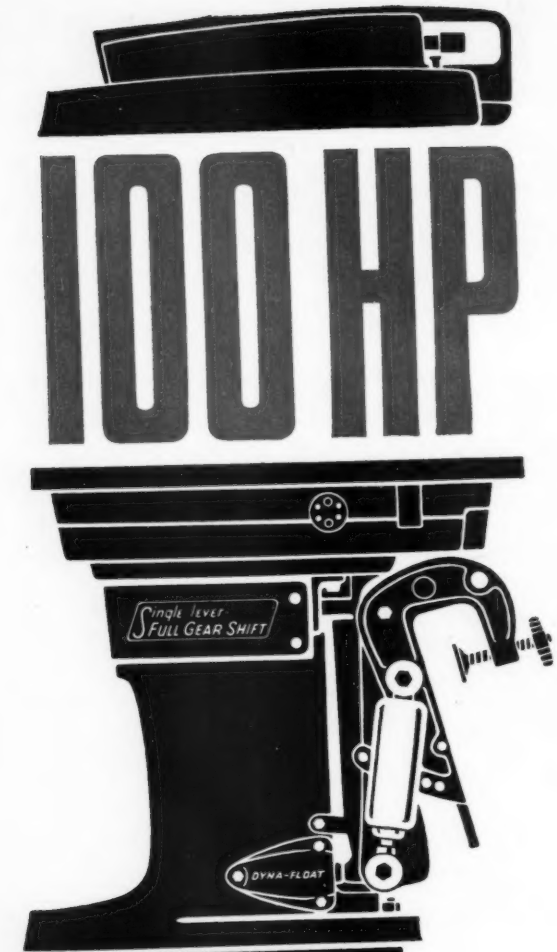
® T.M. of Tyrex, Inc. Transport ®—T.M. Firestone Copyright 1961, The Firestone Tire & Rubber Company

## Says who? (*We* do—*and here's proof!*)

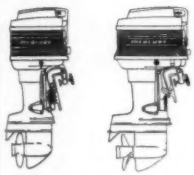
When fleet tests of the new Firestone Transport-100 hit 109,000,000 miles, we knew we *had* something! Findings: up to 50% more original tread mileage and much greater drive wheel traction. It requires only 2/3 the stopping distance most other truck tires took on wet pavements. With a new 3-rib tread design, built with Firestone Rubber-X and Shock-Fortified cord bodies, the Firestone Transport-100 comes to you *at no extra cost*. In nylon or Tyrex® rayon cord, tubeless or tubed, at your Firestone Dealer or Store.

**Firestone**

**TRANSPORT-100 TRUCK TIRE**


100 HP
Single Lever
Full Gear Shift
DYNA-FLOAT

**THE 100 HP PHANTOM** . . . Mercury's newest for 1962—the most powerful outboard motor ever built, yet lighter than most 75's. A new milestone in boating progress, Mercury does it again with a new high in horsepower, a new low in weight. Known as the Merc 1000, it's a full 90 cubic inches and all new from flywheel to prop . . . new power plant with new combustion chamber, new water pump, new gears, new props . . . to hold the extra power. This magnificent power plant is equal to any task. Whether on a big cruiser, runabout or houseboat, the Merc 1000 will give performance that cannot be equaled by other motors . . . and with power to spare! It's for the man who wants the finest outboard motor that money can buy at any price • But that's not all of Mercury's news in 6-cylinder engines for 1962. There's the Merc 850 . . . 85 hp, with Mercury's new *Power-Dome* combustion chamber for smoother idle, quicker response to the throttle and cleaner, quieter operation. It outperforms any motor made by a competitor. And, for versatility you can't beat, see



the new 50 hp Merc 500 . . . and the new attractively-priced Merc 450 . . . 45 hp . . . 4-cylinder in-line engines, streamlined from powerhead to new Jet-Prop exhaust. • Mercury's new Glide-Angle 2-cylinder motors include the Merc 250 . . . 25 hp . . . a light, handsome work horse for fishing, hunting . . . even skiing. Then there's the entirely new Merc 110 . . . 9.8 hp . . . in a 55-pound package . . . 20% lighter than other 10's and

even lighter than competitors' 5½'s. The new 6 hp Merc 60, smallest member of the family, will plane two people in a 14-ft. aluminum boat . . . weighs only 49½ pounds. • All the new 1962 Mercurys have standard-equipment features that you *can't even buy as extras* on other outboard motors. See them right away at your MERCURY DEALER'S. He'll show you how 1962 Mercurys give you . . . more RUN for your money!

KIEKHAEFER MERCURY

©1961, Kiekhaefer Corporation, Fond du Lac, Wisconsin

There is an immediate growing need for trained technicians in
•ELECTRONICS
•RADIO-TV SERVICING
•COMMUNICATIONS
For higher pay and a brighter future, investigate training at home in your spare time with NRI—oldest and largest home study school of its kind.

**SPECIAL TRAINING EQUIPMENT INCLUDED**

Except for FCC License training, all NRI courses include—*at no extra cost*—special training equipment for actual practice at home building circuits, working experiments. Makes theory you learn come to life in interesting, easy-to-grasp manner. NRI catalog we send gives facts about the field of your choice, shows equipment you get and keep. Act now.

MAIL COUPON NOW FOR FREE CATALOG

The Amazing Field of Electronics

**NATIONAL RADIO INSTITUTE**
Washington 16, D.C. 1KB

Please send me free 64 page catalog. (No representative will call. Please print.)

Name ..... Age .....

Address .....

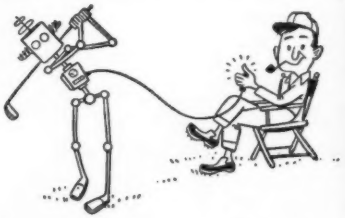
City ..... Zone ... State .....

ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL

*constitutes complete identification. Aniline is sometimes called phenylamine, aminobenzene, phenylid, cyanol, aniline oil, benzidam, and may be written* $PhNH_2$.

**Gripe from a Golfer**

THIS year, a no-stoop gripper for teeing a golf ball ["New Ideas from the Inventors," June]; last year, a club tip for retrieving balls [July '60]. These inventors are going too far; they're destroying the fun and exercise in golf.



Next year: a gadget that drives, chips, and putts to make the game easier?

ROBERT LAFOND, San Diego.

**Which Came First?**

Your Picture News [June] showed an interchangeable truck top or canopy and credited its design to Capt. M. W. Dickerson of Langley Air Force Base, Va.

I don't know who adopted or thought of this idea first, but I do know that I designed and had constructed the very same type of truck canopy five or six years ago. It was used for transporting specialists, tools, and equipment for maintenance on the flight line at Offutt Air Force Base, Nebr.

The canopies we use include seats on both sides. The whole assembly can be lifted from one ¼-ton truck to another in a few minutes by four men.

M/SGT. W. G. CHYLINSKI, Bellevue, Nebr.

**To Keep a Wagon Clean**

FLAPS for the rear of station wagons ["I'd Like to See Them Make," June] are on the market, but I think "scoops" do a better job; and you don't have to get on your hands and knees to clean them. They come in pairs—chromed metal sheets, curved lengthwise.

They're mounted on the tail gate, one on each side, adjusted to "scoop" the wind, bringing it around behind and kill-

CONTINUED

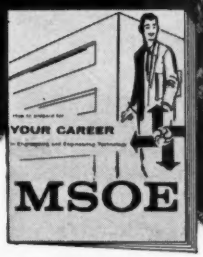
Fancy mover! Gas-saving 4-cylinder engine delivers Pontiac-brand performance in horsepowers ranging from 110 to 140. Extra-cost: 4-barrel, 166 h.p. "four" or 185 h.p. V-8. Automatic trans or 4-speed floor shift • Independent springing front and rear. Each 15" wheel moves up and down independently of the opposite wheel. Rides flat and level. • Only American car with a front engine/rear transmission. Biting traction on bricks or mud. • **Plush new series—the Le Mans (Luh-mahnz)—makes the scene this year in Convertible and Coupe models. Sports-type bucket seats, full carpeting. Take one out.**

PONTIAC MOTOR DIVISION • GENERAL MOTORS CORPORATION

## The gas-saving "4" with Pontiac Punch!

*Drive America's only front engine/rear transmission car . . . it's balanced like none of the others!*

# FREE CAREER BOOKLET




**To guide you to a successful future in**

## ELECTRONICS
## RADIO-TV
## COMPUTERS
## ELECTRICAL ENGINEERING

This interesting pictorial booklet tells you how you can prepare for a dynamic career as an Electrical Engineer or Engineering Technician in many exciting, growing fields:

**MISSILES • AVIONICS • AUTOMATION**
**SALES • DEVELOPMENT**
**ELECTRICAL POWER • ROCKETRY**
**RADAR • RESEARCH**

Get all the facts about job opportunities, length of study, courses offered, degrees you can earn, scholarships, part-time work — as well as pictures of the Milwaukee School of Engineering's educational and recreational facilities. No obligation — it's yours free.

**MILWAUKEE SCHOOL OF ENGINEERING**

**MAIL COUPON TODAY!**

**Milwaukee School of Engineering**
**Dept. PS-1061 1025 N. Milwaukee St., Milwaukee, Wis.**
Please send FREE "Your Career" booklet.
I'm interested in
☐ Electronics ☐ Radio-TV ☐ Computers
☐ Electrical Engineering ☐ Mechanical Engineering

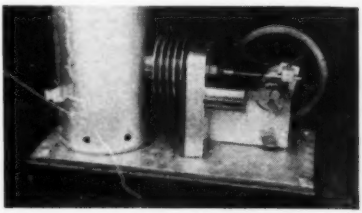
Name..... Age.....
PLEASE PRINT
Address.....
City..... Zone..... State.....
☐ I'm eligible for veterans education benefits.
Discharge date..... MS-117


ing the vacuum. I have them on my station wagon. They look better than flaps and keep the back glass dry and clean.

K. B. KARSTENS, Richmond, Calif.

### Hot-Air Engine Is Real Cool

I SURE hope you'll come up with more projects like Harry Walton's little hot-air engine [Apr. '61]. The picture shows



how I made out when I tackled it. I built the engine out of material from my "hope chest" and it performs very well. I found the timing was quite critical for good performance. I've been building mechanical models for more than 50 years and I don't suppose I'll ever outgrow it.

M. D. TAYLOR, Soquel, Calif.

### Why Cars Like Foggy Weather

IT IS my idea, rooted in the notorious experience of many drivers, that cars seem to drive better on foggy days. The engine seems eager and more powerful, and knock is greatly reduced. This is due, I think, to the water which on foggy days saturates the air. The water is mixed with the air and gasoline and, in the engine's combustion chamber, becomes superheated steam which yields additional power.

Well, I hope this didn't kill you with laughter and that you can give me some explanation of just what does go on in an engine on wet days.

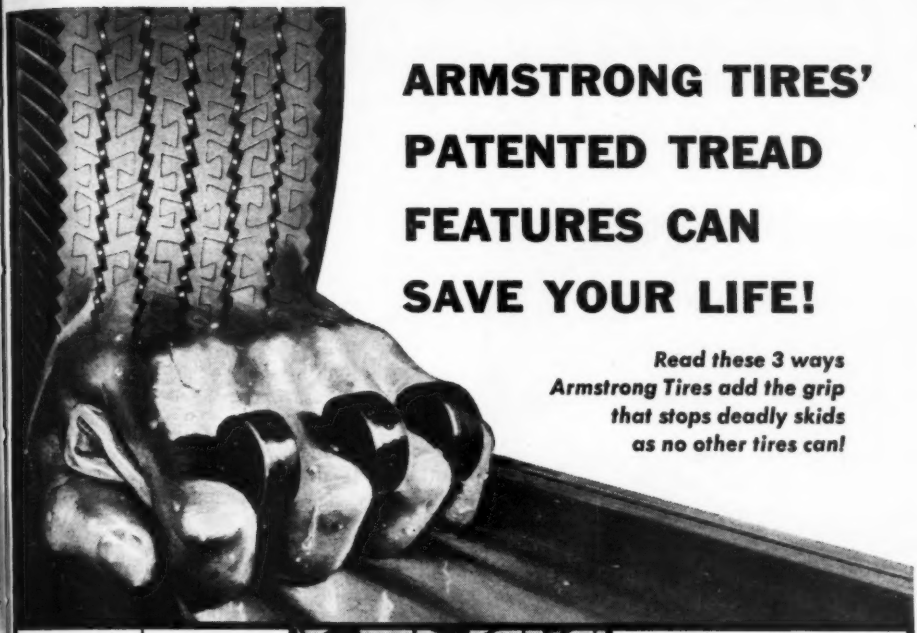
R. SCHMIDT, Caracas, Venezuela.

*Almost everyone has noticed this phenomenon on damp days. It is generally believed to be due to the presence of more oxygen in dense air than in the thin air of a hot, dry day. The more oxygen, the better the combustion. That's why your car seems to run on a cloud when it's running under one.*

### Soap to the Rescue

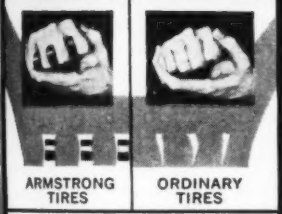
I AM a real Gus fan and I often get a chuckle out of the weird things that hap-

CONTINUED



# ARMSTRONG TIRES' PATENTED TREAD FEATURES CAN SAVE YOUR LIFE!

***Read these 3 ways Armstrong Tires add the grip that stops deadly skids as no other tires can!***

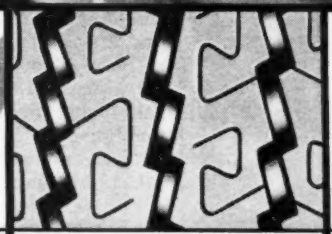



Famous "Ounce of Prevention"

## PATENTED SAFETY DISCS KEEP TIRE'S GRIPPING EDGES OPEN

Just as Safety Discs in fist (above left) keep fingers apart, so over 1000 Safety Discs in each Armstrong Tire keep tread's gripping edges apart, always ready to grip – no matter how hard you brake!

But fingers of fist *without* discs (above right) *can* squeeze shut. That's why ordinary tires, lacking Safety Discs, can squeeze smooth and slippery under braking pressure – *and you skid.*

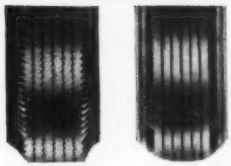


Grip in all directions!

## PATENTED INTERLOCKING SIPES ADD OVER 2600 GRIPPING EDGES!

Sipes are slots put in tires to add gripping edges. Only Armstrong tires have S-shaped, *interlocking* sipes. They add over 2600 gripping edges, provide "bite" in ALL directions, sharply improve protection against forward *and* side skids.

In winter, interlocking sipes' "wiper" action keeps you safer on wet roads, gives you snow tire "go" on packed ice and snow.




Grip where it counts!

## UNI-CUSHION CONTOUR LAYS MORE LIVE RUBBER ON ROAD

Armstrong Tires, when inflated and rolling, put more tread – more gripping edges – on pavement. Greater stability at high speeds! Faster, surer stops when you brake!

Another extra: Armstrong's anti-vibration tread literally cancels noise! No hum, no whine, no drone: you ride on a whisper. Talk to your local Armstrong dealer – he's listed in the Yellow Pages.

*GET EXTRA SAFETY AT NO EXTRA COST WITH*

# ARMSTRONG TIRES!

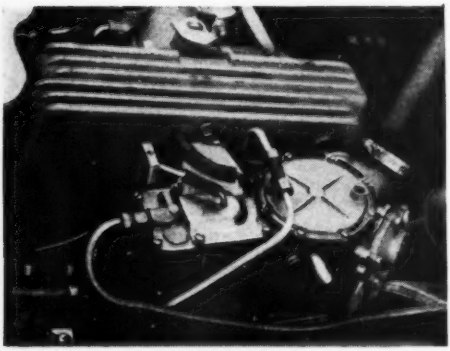
**ARMSTRONG RUBBER COMPANY,** Home Office, West Haven, Conn.

AS LOW AS **$10.95** (6.70 x15)

plus tax and your recappable tire

# Test your automotive I.Q!

**QUICK QUIZ BY QUAKER STATE**



1. *What is the purpose of this alternative to the conventional carburetor?*

2. *What does this symbol stand for?*

The symbol stands for your car's best engine life preserver—Quaker State Motor Oil. Super-refined from 100% pure Pennsylvania Grade Crude Oil, Quaker State keeps your car on the road, out of the repair shop—saves you money! Insist on Quaker State. Available most everywhere. For your dealer's name, call Western Union Operator 25.

ANSWERS: 1. *Fuel injection system, for efficient fuel consumption.* 2. *World's finest motor oil.*

©QSORC, 1961

QUAKER STATE OIL REFINING CORP., OIL CITY, PA.


pen to his customers. I'd like to add to his collection of wacky case histories the tale of the British doctor driving in the middle of the Sahara, with 1,000 miles of dry desert ahead, when his radiator burst.

What would Gus do? Just what the doctor did: Fill the radiator gaps with yellow soap and drive hopefully on. According to the London *Daily Mail*, quoting the doctor: "At first the radiator

bubbled over with soapsuds, but it settled down and carried me safely for another 5,000 miles."

RALPH WESLEY, Minneapolis.

**Inboards vs. Outboards**

I FEEL that Hank Bowman ["How Good Are the New Inboard-Outboards?" June] has missed the point when he says the operating economy of the inboard and the outboard two-cycle are practically on a par. The figures he quotes are for wide-open-throttle conditions and the gallons-per-hour should be approximately the same. In fact, a good rule of thumb for any engine at wide-open throttle is 1 gal./12 hp./hour.

For those who don't race, but troll at 5-6 m.p.h., the picture is entirely different. Trolling in my 85-hp. Grey marine inboard at 12,000 r.p.m., I use about a gallon an hour. When I trolled in a 30-hp. outboard, I used about three. Outboards are not economical at low speed. Low speed means retarding the spark—a very uneconomical proposition. The outboard engine sucks in a full charge of gasoline and air mixture at all speeds. The four-cycle inboard only sucks in a partial charge of gas with an advanced spark at low speed.

R. A. BARNARD, Nokomis, Fla.

. . . AS DESIGNER of the Kermath Screwball vertical inboard engine, may I correct your statement that there were "few orders." Because of conditions within the company that prevented tooling and production—and ultimately caused me to

[*Continued on page 24*]

By Martin Mann

# The month in science

**The man-horse from outer space.** Since the creepy notion that millions of unknown planets are inhabited by intelligent creatures has now become respectable, scientists are muscling in on the science-fiction writers and predicting what these Space Beings look like. The professors sneer at the blonde hussies and antenna-headed green goblins of the comic-strip space world. Yet the Space Beings they dream up are just as weird. Centaurs, for example. That idea comes from no less an authority than William Howells, professor of anthropology at Harvard. He expects to find extraterrestrial creatures that combine horse bodies with human arms and heads, like the centaurs of the old Greek myths. And he makes a convincing case in a section of his book "Mankind in the Making" (Doubleday, $4.95).

Space Being: bimanous quadrupedal hexapod?

Professor Howells reasons that intelligent creatures need to move around—otherwise they can't accomplish anything. So Space Beings must be self-contained, with some kind of bones to hold them up, a nervous system (probably electrical, like ours) to control operations, and a liquid supply system—"we can hardly suppose that nourishment flows through their veins in the form of breakfast cereal." The main center of the nervous system—which has to be big for intelligence—would make a lump like a head.

Space Beings will not be insects, because insects are designed for living by instinct, not by learning and thinking. They will not be birds because birds are stupid, too; flying is so difficult that bird brains must concentrate on muscle coordination. They might live in the water. But land creatures are more likely.

Hands are essential because hands appear to be the only efficient mechanism for doing things. (Doing things is what made humans human.) Hands require arms: just two because three wouldn't balance and four or more would be too difficult to coordinate. Hands also require fingers; five is probably the best number—it can't be coincidence that humans still have the same complement of fingers that the earliest land-living animals started out with millions and millions of years ago.

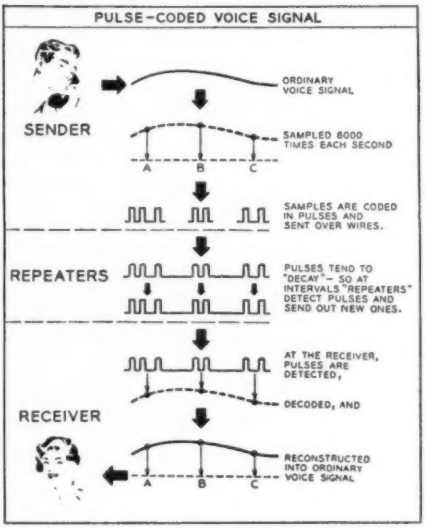
Now for legs. Earthmen have two—it was either balance on two legs or do without hands. Hands were the wise choice, even though two-legged support has led to chronic backache and other troubles. The human pattern was set way, way back when ancient fishes kept only four of their many fins as they evolved

CONTINUED

into amphibians. On other planets, evolution could have taken a different turn at this point. Some practical purpose, unknown to us, might have forced early animals to keep an extra pair of limbs. These could eventually become arms and still leave four legs for sturdy support. Says Professor Howells: "I will lay a small bet that the first men from outer space will be neither bipeds nor quadrupeds, but bimanous quadrupedal hexapods."

**Talking in code.** The Telephone Company is switching over to a modern version of the old Morse code to carry ordinary telephone conversations within city areas. The big advantage: More traffic can be handled without laying more cables.

The new system, called PCM (for pulse-code modulation), is the most radical change in short-distance telephoning since Alexander Graham Bell called Mr. Watson. Until now, the phone transmitter produced an electrical replica of your voice—a current that steadily varied just as your voice did—and sent this replica over the wire to the other end, where the receiver converted the electrical replica back into sound. With PCM the transmitter and receiver work as before. In between, things are completely different. The current from the transmitter—that steadily varying electrical replica of your voice—is chopped up. Every 1/8,000 second, a sample is sliced from it. Not even the slice is sent over the wires. Instead, its electrical strength is automatically measured. Only this measurement is sent over the wires—in code, a short string of pulses. At the other end, circuits remake each sample slice from its code prescription. The newly made slices run together to recreate the electrical voice signal for the telephone receiver.




PCM is an old scheme [PS April '48], but has not been used here before for telephone service. What makes it economically attractive now is the development of small, simple transistor repeaters that can handle 1,500,000 pulses per second. That many pulses can represent samples from a great many different conversations; a lot of people can talk over the same wire at the same time. The repeaters are needed because the pulses "decay"—weaken and become unrecognizable—after traveling more than about a mile. These are true repeaters (like the old telegraph repeaters) and not amplifiers (like the usual telephone amplifiers)—they simply send out a brand-new, freshly minted pulse every time an old worn-out one comes in.

# Earn Extra Money Soon

## ..while training at home for high-pay career or business of your own!

## AMAZING PLAN FOR YOUR SUCCESS IN RADIO-TV-APPLIANCES and ELECTRONICS

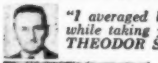
Central will show you how to start making money soon . . . servicing AM-FM radios and television sets . . . repairing electrical appliances . . . building and installing electronic equipment in homes, factories, and business offices. Step-by-step, you'll learn how to get started in spare time at minimum cost; how to prepare for a bright future in servicing, audio, communications, broadcasting, or the gigantic electronic industry. Complete FCC license preparation included. High income, prestige, security, prosperity . . . *all can be yours!*

**Central grad GLEN LEIRER, shown here, earned an attractive income from part-time Radio-TV Servicing. Now he's employed as a Computer Technician for RCA Service Co., Camden, N. J.**

### NO EXPERIENCE NEEDED!

You don't need high school diploma or previous knowledge of electronics to get started. Quick, low-cost home training for young and old. New illustrated lessons make learning easy. We supply equipment and *know how* you need to start making money soon. You learn by *doing*. You assemble useful, practical electronic projects—no incomplete "student" radios and testers—our kits meet commercial standards. Also recommended for citizen band and amateur radio operators, hi-fi and stereo enthusiasts, hobbyists, etc. Your personal pleasure and the savings you can make on home installations and repairs alone, make this course a profitable adventure. Keep your present job—set your own pace—add to your income—and find out how much fun Electronics can be!

### Over 50,000 Successful Graduates Since 1931!



*"I averaged between $60 and $70 a month servicing radios and TV's part-time while taking your home study course. Plan to open my own shop soon." Student THEODOR SCHMIDT, Peshastin, Wash.*

Central grads HOWARD EDMONDS & FLOYD CONKRIGHT are joint owners of EDCO FACTORY TV SERVICE CO., K. C., Mo., and RANCH MART TV & STEREO, Leawood, Kansas, have three service trucks, seven full-time employees.

Grad FRANK LEENKNECHT works in missile field for Convair Astronautics, San Diego, Calif., and as Transmitter Engineer for Station KDEO as a sideline.

### New Frontiers Need You!

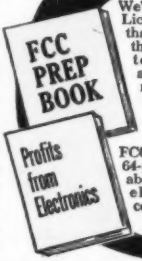
Cash in on growing demand for technicians in hundreds of exciting space-age fields: guided missiles, rocketry, outer space research and development, automation, nuclear power, computers, microwaves, radar, communications, oil field exploration, air traffic control, civil service, armed forces, etc. *Start now.* Get facts—mail coupon today for two FREE books!

### NEW KITS!

You will build and keep this handy "transistorized" electronic and appliance tester that you'll use soon to start earning spare-time money. Many other practical and profitable electronic projects to choose from: *4 transistor portable radio—code oscillator—solar cell switch—RF signal generator—CB converter—oscilloscope—others!* Fully described in our FREE 64-page catalog.

**RESIDENT TRAINING** -- Central also offers a full-time ECPD-Accredited Technical Institute program at its resident school in Kansas City, Mo., for qualified high school graduates. Details in FREE catalog.

## FREE




We'll mail you FREE FCC License Prep Handbook that prepares you to pass the *3rd Class* FCC Radiotelephone examination, and to qualify to operate radiotelephone transmitting stations used by airlines, police, railroads, emergency services, etc. You get FREE FCC Prep Book plus FREE 64-page catalog with facts about Central's practical electronics home study course.

NO OBLIGATION

### TRADE THIS COUPON FOR 2 FREE BOOKS!

**Central Technical Institute**
1644 Wyandotte, Dept. PS101A
Kansas City 8, Mo.

(PLEASE PRINT)

NAME.....

ADDRESS.....

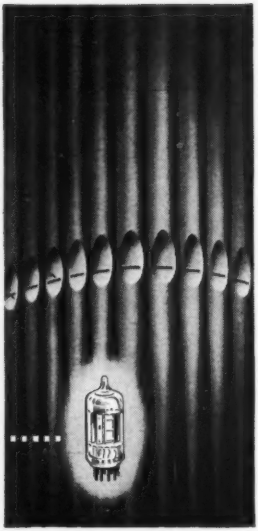
CITY.....

ZONE.....STATE.....

Accredited Member
National Home Study Council

## Central Technical Institute

*Schober*
**captures magnificent pipe organ tone in a tiny electronic tube. .....**



Here is magnificent Pipe Organ tone; tremendous tonal color range; two 61-note pipe-organ keyboards; hand-rubbed cabinetry in the finish of your choice. Taken together they comprise a superlative electronic instrument comparable to organs selling for $2,500 to $6,000.

Yet, when you assemble the Schober of your choice, you save more than half the normal cost and create a superb instrument to bring the delightful gift of music to your family.

Work requiring knowledge and experience is eliminated. All that remains is the pride and pleasure of watching a fine musical instrument take shape under your own hands. The Schober organ you assemble will equal or surpass any factory-built organ for quality, reliability and circuitry.

The coupon brings you full details on how you can start building the Schober of your choice with an investment of as little as $18.95. In addition, you may have an exciting 10" LP record demonstrating Schober's full range of tones and voices. The $2 charge for the record is refunded when you order your starting kit. No salesman will call.

**THE SCHOBER ORGAN CORPORATION**
**Dept. PS-9, 43 West 61st St., N. Y. 23, N. Y.**

The Schober Organ Corp.,
Dept. PS 9
43 West 61 St., N.Y. 23, N.Y.

☐ Please send me FREE full-color booklet and other literature on the Schober organ.

☐ Please send me the Hi-Fi demonstration record. I enclose $2 which is refundable when I order my first kit.

name_____

address_____

city_____ zone____ state_____

leave Kermath—checks and orders were returned in large numbers.

Peculiar to the marine-engine business is that the gearing costs more than the engine. The Screwball never was an I-0 drive. None of the machinery shown in your sketch of the Eaton drive is needed. Three gears, three double bearings, and 20-odd more assorted parts cost plenty. The problem of what drive to use was that simple, almost.

Automotive engines are heavy and, in the test data reported, the I-0 drive may well have suffered from imbalance, as you suggest. Change a planing hull to a semidisplacement hull and performance evaporates.

This plagued me until I designed engines for the job—engines that can be installed in outboard hulls without paying a penalty.

OLIVER FRASER, W. Hartford, Conn.

### Those Motorized Slowpokes

ONE of the editors of our British magazine, *The Motor*, has coined an expression that should amuse drivers everywhere. It aptly describes one road nuisance:

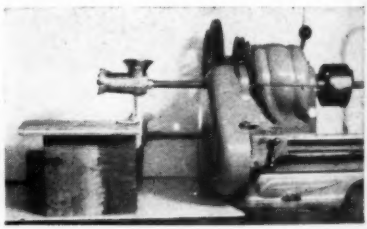
The Abominable Slowman.

R. L. RIGBY, London, England.

### Got Any Meat to Grind?

THEY say a lathe can do anything. With a very simple arrangement, I've got mine grinding meat.

I removed the handle from our meat grinder and slipped tubing over the stub



shaft. The other end of the tubing is pushed through the headstock of my lathe and tightened in a three-jaw chuck. A wooden stand brings the grinder even with the tube coming out of the headstock.

If a universal joint is attached to a piece of tubing, the lathe can be made to drive other tools or machines.

ALEX RIBAK, Bridgeport, Conn.

## Shrinks Hemorrhoids New Way Without Surgery Stops Itch – Relieves Pain

For the first time science has found a new healing substance with the astonishing ability to shrink hemorrhoids and to relieve pain – without surgery.

In case after case, while gently relieving pain, actual reduction (shrinkage) took place.

Most amazing of all – results were so thorough that sufferers made astonishing statements like "Piles have ceased to be a problem!"

The secret is a new healing substance (Bio-Dyne®)—discovery of a world-famous research institute.

This substance is now available in *suppository or ointment form* under the name *Preparation H®*. Ask for it at all drug counters.

---

**MEN WANTED**

Earn $125 Per Week and up AUTO DIESEL MECHANICS

Master a trade with a future — learn Auto-Diesel mechanics in our shops. You learn with tools on real equipment. Earn while you learn. Many of our graduates earn $125 per week and up. No previous experience necessary. Day and night courses. Approved for veterans.

Write for free bulletin
AUTO-DIESEL COLLEGE
226 7th Ave., N., Dept. 41
Nashville 3, Tenn.

---

**UNIVERSAL SAFETY ESCAPE LADDER**

*A Real Life Saver for Home and Industrial Use*

10' . . . $15.95 LIGHT, SELF-STORING,
25' . . . 26.95 ZINC-PLATED, 3000
35' . . . 36.75 LBS. TENSILE STRENGTH
45' . . . 46.75

SOLD SINCE 1939

ALSO AVAILABLE IN STAINLESS STEEL—$95 to $427.50

15' 25 lb. 2-story, in self-storing container direct factory-to-you. Only ..... **$19.95**

*Send check or M.O. . . . $5 deposit on c.o.d. Shipped express collect*

PLANK & SONS ENGINEERING DEVELOPMENT CO.
7623 30th St., S.E., Ada, Michigan

---

## CIVIL SERVICE EXAM FITNESS BY HOME STUDY

Perhaps you can enter this most attractive field of work by passing a written test after home study preparation. Find out. Act now! Information FREE.

**FRANKLIN INSTITUTE, DEPT. B1, Rochester 4, N.Y.**

---

PELLET FIRING
**LUGER AUTOMATIC**

- MAGAZINE LOADING CLIP
- OVER 15 MOVING PARTS
- FULLY AUTOMATIC

ONLY **$1.98**

Automatic full size model of a Luger Automatic pistol —contains over 15 moving parts. Loads 8 complete rounds which snap into the hard butt simulating a Luger. Fires 8 bullet shaped pellets. Has automatic slide action.

**MOST AUTHENTIC MODEL GUN WE'VE EVER SEEN**

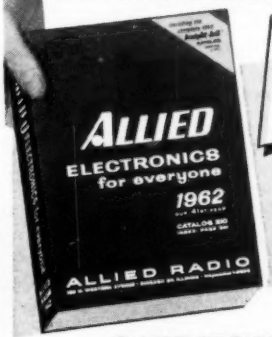
Comes to you with working parts disassembled with cleverly engineered springs, full instructions, supply of pellets and specially designed belt holster. **Full Money Back Guarantee.** Simply send $1.98 plus 27¢ shipping charge or order C.O.D. From:

HONOR HOUSE PROD. CORP., Dept. LL-42, Lynbrook, N. Y.

---

free **ALLIED**

**MONEY-SAVING 1962 ELECTRONICS CATALOG**




444 PAGES
WORLD'S BIGGEST MOST COMPLETE

NO MONEY DOWN
EASIEST TERMS

**SAVE MOST ON EVERYTHING IN ELECTRONICS**

Send for this FREE catalog—it's the biggest—featuring everything in Electronics for modern living, including products and values available only from ALLIED. Whether you're a kit builder, experimenter, hi-fi fan, Amateur, serviceman or engineer, you'll save most on:

- *KNIGHT-KITS®—Best in Build Your Own
- *Everything in Stereo Hi-Fidelity
- *New Multiplex Stereo FM
- *New All-Transistor Stereo Hi-Fi
- *KNIGHT® Super-Value Stereo Hi-Fi
- *Tape Recorders & Phono Equipment
- *Citizens Band 2-Way Radios
- *TV Tubes, Antennas, Accessories
- *Parts, Tubes, Transistors, Tools, Books
- *Amateur Station Equipment
- *Public Address & Intercom
- *Latest Test & Lab Instruments

**SAVE** on everything in Electronics at ALLIED—get fastest service, expert personal help, easiest-pay terms, satisfaction guaranteed or your money back. Send coupon today for FREE 1962 ALLIED Catalog.

free CATALOG

THE WORLD'S LARGEST ELECTRONIC SUPPLY HOUSE

**ALLIED RADIO**

ALLIED RADIO, Dept. 42-K1
100 N. Western Ave., Chicago 80, Ill.

☐ Rush FREE 1962 ALLIED Catalog.

*Name*_____
PLEASE PRINT

*Address*_____

*City*_____ *Zone* *State*_____

# DETROIT REPORT

By Devon Francis

## End of the Smog Makers?

TWO years from now, and perhaps even sooner, it seems certain that every auto turned out by Detroit will have a device in its power-plant innards to reduce by a third the foul unburned gases blown out into the air. Abraham A. Ribicoff, U.S. Secretary of Health, Education, and Welfare, has said as much.

Unless auto manufacturers install a means of reducing air pollution, Ribicoff warned them, he will ask Congress for a law to make them do it. The earliest this could go into effect—by law—would be about this time in 1963 for cars of the 1964 model year. But a voluntary push by the industry could cut the time in half. Right now, every new car delivered in California already conforms to the Ribicoff edict—but by California, not Federal, law.

How much would the gizmo cost the purchaser of a new car? Around five dollars—and perhaps less.

Despite advances in engine engineering, modern gasoline engines still have a long way to go. Like a kerosene lamp that uses only part of the energy potential of its fuel—that flame the wick throws up is yellow because hydrocarbons in the fuel remain unburned—the cylinder heads of a gasoline engine also waste hydrocarbons. Only a fourth of the energy in the fuel is actually consumed when the spark ignites it. The unburned part goes two ways: some out the tail pipe, some into the crankcase.

As yet, little has been done about the emissions from the tail pipe. But the unburned hydrocarbons in the crankcase—deposited there by "blow-by" past the pistons—are, in part, controllable. The crankcase has a breather tube to vent the foul gases into the air.

The simplest way to cope with crankcase gases is to pipe them back into the cylinders for another go-'round. It's like feeding the unburned gases of the kerosene lamp back into the fuel bowl. That is what is being done by the antipollution devices with which cars in smog-plagued California are fitted. The most popular device is made by GM's AC Spark Plug division.

Meantime, attacks are also being made on the emissions from tail pipes. After more than two years of research, W. R. Grace & Co. has produced a catalyst to be put in mufflers. It is said to render a lot of noxious fumes harmless.

**Supersecret: The XP 715.** Despite denials by Buick that it will bring out a Thunderbird-type sporty (not sports) car during the 1962 model year, work is being pushed on the project. Code name for the car is XP 715. It has a fiber-glass body, though there's no assurance that it will be made that way on the production line.

An interesting feature of the car is that its wheels, unlike those on almost all GM cars up to '62, will have tapered roller bearings rather than ball bearings. Tapered bearings—now standard on Olds and Pontiacs—adjust more readily to the torque put on the outside nut on the axle by the production worker or your garage mechanic.

**The cupcake body.** Speaking of fiber-glass, it's entirely possible that some auto makers will adopt an idea propounded more than 20 years ago by the late Bill Stout, designer of the Ford trimotor airplane.

Stout argued endlessly but to no avail at Ford for dentproof car bodies made of plastic reinforced by fiber-glass. His views were justified when Kaiser, and later Corvette, produced just such bodies.

Creative Industries, of Detroit, recently built a compact-size car with only 11 plastic body panels compared with the more than 90 used in the Corvette. Such bodies are turned out in forms, like cupcakes.

Other ideas are brewing, such as use



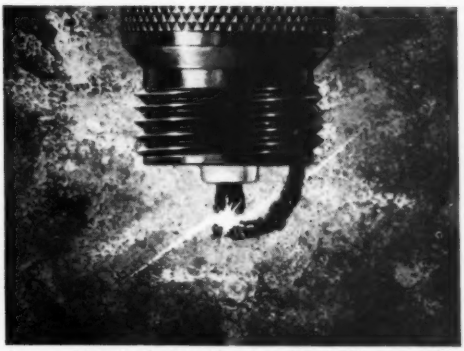
CONTINUED

# !NEWS!

## FORD MOTOR COMPANY SWITCHES TO AUTOLITE

Autolite Spark Plugs are now specified for original equipment installation on every vehicle that rolls off Ford Motor Company assembly lines. And they are strongly recommended by Ford Motor Company engineers for replacement use in all units now in service. Why does Ford Motor Company, like so many other manufacturers, specify Autolite? One of the main reasons is the way Autolite Power Tip actually cleans itself while you drive. See pictures below.

In each Autolite Power Tip spark plug the electrode or firing tip is longer than usual. This tip is made of a special heat resistant alloy. Now, watch what happens.



As you drive, lead and other harmful, fouling deposits start to accumulate on the firing tip. If allowed to remain, they will eventually short out and kill the plug.

But the firing tip on an Autolite Power Tip spark plug extends deeper into your engine. Deposits are immersed in the searing heat of the exploding gasoline.

With a Power Tip, each time your engine fires, the deposits are actually burned away. Your spark plugs stay clean, so that your mileage and power stay at their peak.

**AUTOLITE SPARK PLUGS**
*Clean themselves while you drive*

of reinforced plastics—following the lead of Chrysler in this field—for parts of car bodies. Experiments are in progress for molding one panel for the car-trunk floor, spare-tire well, and gas tank. Another thought: Cloth trim could be attached to plastic car doors while they were being fabricated. Why not attach a rug to the entire floor pan in the manufacturing?

There's a catch, of course, to all of this—steel bodies cost less when the production run exceeds 50,000 cars.

**Updated Volkswagen.** A lot of changes have gone into the '62 Volkswagen announced last month. The gasoline gauge on sedans—a running change on the production line for '61—has been added to Karmann Ghia coupes, station wagons, and trucks. The reserve tank-control cock is, in consequence, gone. Most VW owners won't miss it.

Other alterations include: larger tail and brake lights; a special switch that blinks all four turn signals continuously on trucks and wagons in emergency; safety-belt anchorages (for over-the-shoulder belts); improved heater outlets; a windshield washer; a front hood spring; a softer brake pedal; and some permanently lubed points, such as tie-rod joints.

**Wrong forecast: rain.** Tinted windshields always make a light-gray sky look as though a storm is brewing. A chemical company may have the answer—a substance in the glass that tints up only in bright sunlight.

**Those bloody tail lights.** Something else is cooking, and it will be served up before not too long. That's a system for increasing the intensity of rear turn and stop signals in daytime. Now, in bright sunlight, they're often too dim to be seen.

But make 'em brighter and you create another problem. At night, they'd dazzle the driver behind you. The answer: resistors to cut intensity of the tail lights when headlights are switched on. (A British company is coming out with the same system, too.)

**Superchargers for '64.** With most of the 1962 cars in the showrooms, what's Detroit got up its sleeve for the future? Here's a long-range peek at the drawing boards.

For 1964—and possibly even earlier—look for a development that will snatch the hat right off your head. It's a medium-size car with the around-town gas economy of a Volkswagen and the open-road performance of one with 200 horses under the hood.

The secret: a "blown"—that is, supercharged—engine.

The idea is being pushed hard at both Oldsmobile and Chevrolet. Small and rugged, the power plant would use a good portion of the 40 percent of energy potential that goes out the exhaust pipe of today's typical car engine.

The objective is to triple or even quadruple the horsepower produced by an engine of a given piston displacement. The supercharger would, of course, have to be something special. Those now available boost power by only half again, or less.

A unique feature of this arrangement could be a switch that would permit the driver to turn the supercharger on and off. Why use all the machinery for added power in simple city driving? It goes without saying that the engine would have to be built to withstand the extra stresses and heat generated by higher compression ratios. Shape of things to come may be embodied in the design of the four- and six-cylinder engines for the new Chevy II (see page 68 for story and pictures).

# CLEAN CARBURETORS RIGHT ON-THE-ENGINE

**Low cost CARBURETOR CLEAN-OUT KIT boosts engine performance—stops gasoline waste**

Stop engine stalling, hard starts, rough idling and gas waste caused by a dirty carburetor. Now you can clean carburetors the professional way and at the lowest cost with GUMOUT and the easy-to-use CLEAN-OUT KIT. Simply hook up the kit, turn on the engine and GUMOUT goes to work. It takes just a few minutes. Clean your carburetor three or four times a year this modern way, and you'll save many dollars in repair and operating costs.

There's nothing like GUMOUT for quick results!

The CLEAN-OUT KIT will give you many years of service. Use it with GUMOUT, the carburetor cleaner that gives instant results.

## GUMOUT

in the pint can is used with the CLEAN-OUT KIT. GUMOUT also gives excellent results added to the gas tank.

**$1.69**

## CARBURETOR CLEAN-OUT KIT

Packed in a re-usable slide-on blister package. Fits all American made cars, trucks, tractors. Easy-to-follow directions come with the kit.

**$2.49**

Buy GUMOUT and the CLEAN-OUT KIT from your favorite auto supply store or write:

**GUMOUT® DIVISION, PENNSYLVANIA REFINING COMPANY**
Cleveland 4, Ohio

# PS Puzzlers By Joan Steen

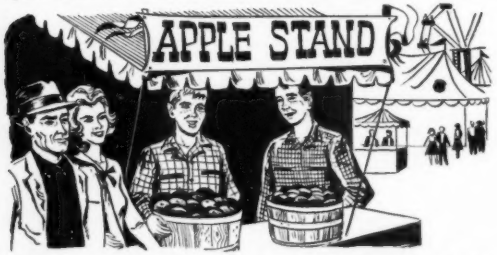
***October's harvest to harry you . . . Answers on page 205***

## Dinner-Table Tricks

IF YOU plan to baffle your friends with neat puzzles that need props, I say make the materials neat, cheap, and easy to get ahold of. That's why I like these two pint-size puzzles. Kenneth Swezey likes them, too. You'll find them in his *After-Dinner Science*. Both use materials you can find on the dinner table:

1) Can you remove an ice cube floating in a cup or glass of water with the help of a short piece of string? (Plus anything else handy on the table.) No, you can't truss it up or spoon it out.

2) Can you balance a cup, some napkins, and two dinner knives on the tip of your index finger?




HERE's a juicy problem. At the Harvest Fair, Mr. Jones left his two boys in charge of the apple stand, telling them they could keep whatever they made. Pete was to sell the larger apples at two for a penny. George was to sell small ones at three for a penny. Both had the same number of apples.

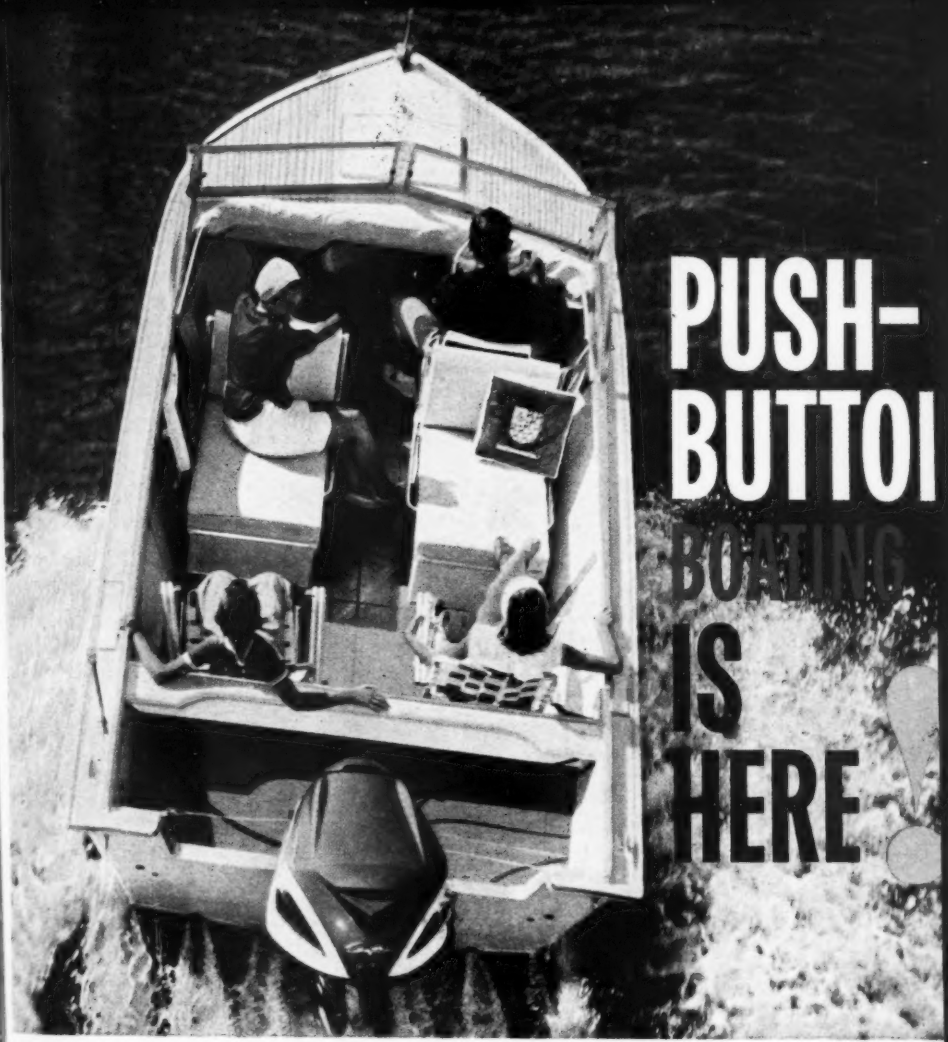
George, being a wily sort, turned to Pete and said, "Look, there's no use both of us wasting the afternoon. You go and I'll dump all the apples together and sell them all at five for two cents—that's the average. And later we'll split the profit."

Pete, a lazy type, agreed. It wasn't until the end of the day, after all the apples had been sold, that Pete realized he'd been had. Not only was the total taken in seven cents less than it should have been, but when it came to divvying up the profits, Pete took an even greater loss. Can you figure how much?

THE rules are simple for this Martian puzzle of Sam Loyd's. Starting at the South Pole (T), trace your way through all the canals and cities and see if you can spell out a complete English sentence using each letter only once, and ending up at the starting point.

You might be amused to know that Loyd says that when the puzzle first appeared more than 50,000 readers wrote in to report, "There is no possible way." And yet Sam says it's easy.

CONTINUED

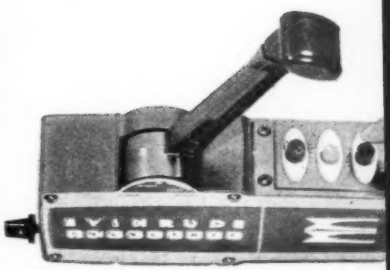


# PUSH-BUTTOI

## BOATING IS HERE

Try the greatest advance in outboard boating control since the driver moved up front! Simply push a button to go forward . . . shift to neutral . . . or reverse. Evinrude's new Selectric Shift gives you instant control, electrically, in every maneuvering situation. This exclusive feature sets the pace for progress in the entire 1962 Evinrude line. There are ten models . . . in 3, 5½, 10, 18, 28, 40 and 75 hp sizes . . . with engineering refinements like automatic choke . . . fool-proof, fixed-jet carburetion . . . thermostat-controlled cooling . . . quiet, cushioned, sound-sealed power. Even electric power motor tilting is available on the 75 hp V-4 Starflite IV! ■ There's a new 40 hp Lark IV, with Selectric Shift and new high-efficiency lower unit. There's a brand new 28 hp model with the emphasis on value — a dollar-for-dollar "best buy" if there ever was one. ■ For the world's most versatile pleasure power — see your Evinrude dealer. He's listed in the Yellow Pages under "Outboard Motors." Bring along your finger and try new push-button boating! ■ Free 1962 catalog! At your dealer's or write Evinrude Motors, 4172 North 27th Street, Milwaukee 16, Wisconsin.

*(In Canada: Peterborough, Ontario) A Div. of Outboard Marine Corp.*




**WORLD'S MOST VERSATILE PLEASURE POWER!**

**EVINRUD**

## PS Puzzlers continued

SURELY the shortest, most concise, of all logical puzzles is this one:

A says, "B lies."

B says, "C lies."

C says, "A and B both lie."

Is there anyone who's telling the truth?

A PAIR of odd puzzles for you: One's an odd calcu tion, the other's a calculated odds.

1) How many pairs of numbers are there that both and multiply to the same amount? (Include fractions.)

2) In a scheduled three-horse race, the odds agai Sport are two to one, the odds against Favorite Son three to two. What should be the odds against Blac (if races were run by the rules of probability)?

### Puzzle of the month

YOU'RE marooned on a desert island and i becomes vitally important to bisect a lin segment. But when the ship sank, all you rescue was a compass (the kind you make circles with) You have no ruler. Can you still bisect the seg ment? (Unlike trisecting an angle or squarin a circle which are impossible even with a rule and compass, it *is* possible to bisect a line seg ment with a compass alone.) There is a straight forward solution that you can prove. There i also an alternate way that leads to a fascinatin branch of geometry. (Answer next month.)

**Answer to last month's P-O-T-M:** Two ladders, a 20-foot and a 30-foot one, stretch in opposite directions between two walls. They cross at a point 8 feet above the ground. What is the width of ground between the walls?

When I looked at the diagram, I winced at all the similar triangles and decided that that way meant grief. So I used a graphical approach—not exactly cheating, but not Simon-pure and elegant either.

Using a sheet of graph paper on which I'd ruled a base line, I laid out a circular arc 30 units long. Then, using the compass as dividers, I measured a 20-unit length from appropriate base-line points and determined the crossing points. The one that gave the closest to an 8-units high reading corresponded to a base width of 16.2+ units. That was enough for me.

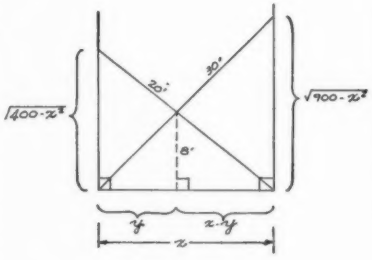
You can check this against the cumber some algebraic equation that arises fron the similar triangle approach:

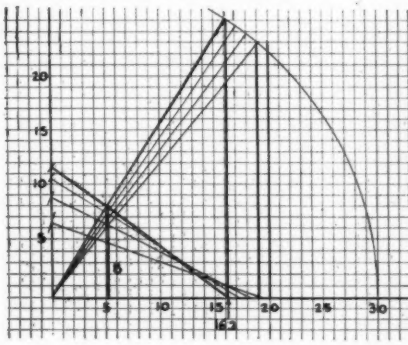
$$\frac{8}{y} = \frac{\sqrt{900 - x^2}}{x}, \quad \frac{x - y}{8} = \frac{x}{\sqrt{400 - x}}$$

Solving each of these equations for and then setting them equal to each othe yields:

$$\frac{8}{\sqrt{900 - x^2}} = 1 - \frac{8}{\sqrt{400 - x^2}}$$

This, in the language of mathemat cians, is very messy indeed.



odd calcula-

hat both add
ractions.)
odds against
orite Son are
ainst Blackie
y)?

and and it
ect a line
ou rescued
cles with).
ct the seg-
r squaring
ith a ruler
a line seg-
a straight-
e. There is
fascinating
nonth.)

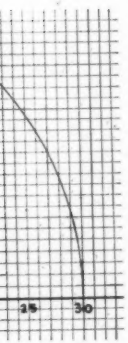
an 8-units-
a base width
ough for me.
the cumber-
arises from
:

$$= \frac{x}{\sqrt{400 - x^2}}$$

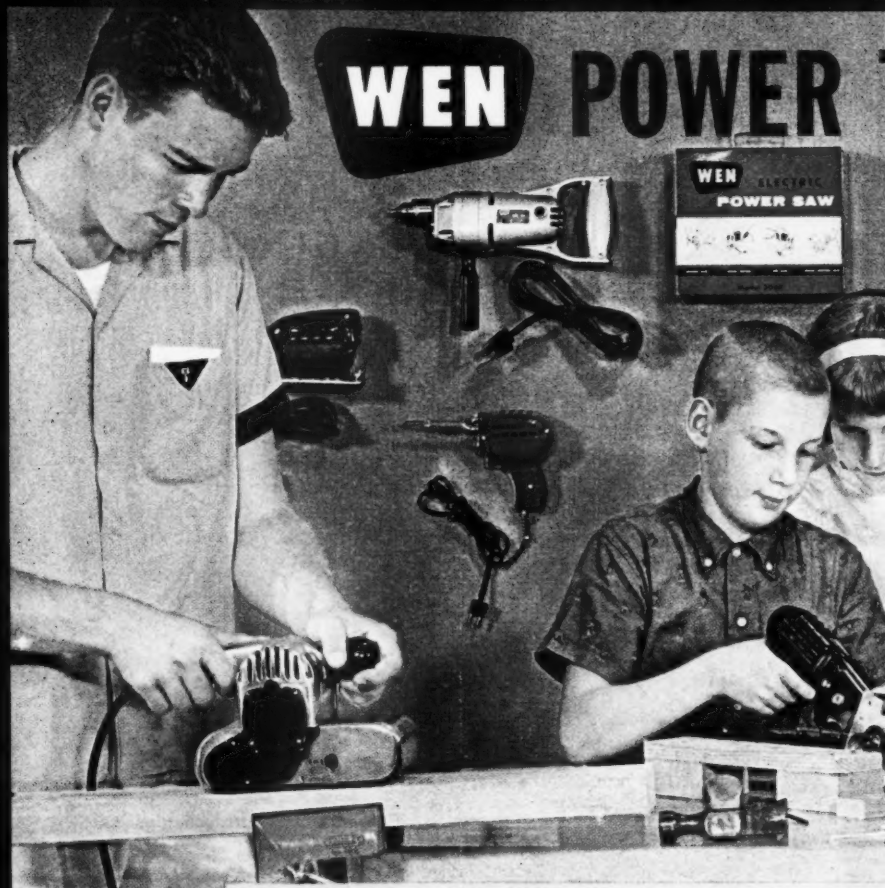
ations for y
to each other

$$\frac{8}{00 - x^2}$$

mathemati-



# WEN POWER

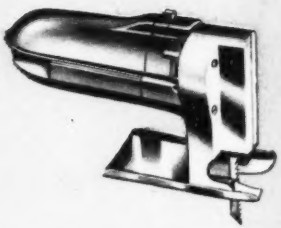


**Quick to Heat**
**Easy to Use**

## WORLD'S BEST SELLING SOLDER GUNS

Choose from 4 guns, 2 gun kits—from feather-light slim 100 watt model to heavy-duty 250 watt model standard among professionals. All guns are heated, ready to use in 2½ to 5 seconds . . . quick to cool. Built-in spotlights focus on work. Housings are shatterproof plastic. Long-reach, long life tips are replaceable and interchangeable with special purpose tips. $5.95 to $15.95

**2650 5/16" Strokes Per Minute**



## LIGHTWEIGHT ALL-PURPOSE SABRE SAW

Extremely versatile and easy-to-handle, this fine saw is excellent for scrollwork and patterns. Slices through 2x4's in seconds. Cuts wood, metal, plastics, composition boards, hard rubber, leather. Air stream clears dust from work. You get a true cut every time. It's a must in your workshop . . . the finest of its kind. $26.95

# ER TOOLS-BEST

**" Strokes Per Minute**

**-PURPOSE W**

nd easy-to- is excellent tterns. Slices conds. Cuts s, composi- ber, leather. t from work. ery time. It's shop . . . the 6.95

**14,400 Strokes Per Minute**

**BEST QUALITY FINE FINISH SANDERS**

Straight-line lightweight sanders —essential in furniture finishing, fine woodworking. Choose from 3 models—handy 14 sq. in. economy model at $13.95, in a metal kit with extra paper at $16.95, or heavy-duty model with big 20-inch sanding surface, in metal kit with extra paper, at $19.95. All have strong molded plastic housings with exclusive patented super-power magnetic motors driving 14,400 strokes per minute. Perfect for professional and amateur alike!

**DOUBLE- MOST VE IN YOUR**

*No other drill* geared chuck easily, yet d easy to handl a jiffy. 3000 thin metal a RPM for thic plaster and every job at t polish, sand, mix paint, d name it. $29

RUE, SPORTS ILLUSTRATED, PLAYBOY, ESQUIRE, POPUL

# OLS-BEST BUY FOR YOUR

**0 Strokes**
**linute**

**BEST QUALITY**
**FINE FINISH SANDERS**

ght-line lightweight sanders
ential in furniture finishing,
woodworking. Choose from
odels—handy 14 sq. in.
my model at $13.95, in a
kit with extra paper at
95, or heavy-duty model
big 20-inch sanding surface,
tal kit with extra paper, at
95. All have strong molded
ic housings with exclusive
nted super-power magnetic
rs driving 14,400 strokes per
e. Perfect for professional
amateur alike!

**2 Professional Speeds**
**⅜" Jacobs Chuck**

**DOUBLE-DUTY DRILL**
**MOST VERSATILE TOOL**
**IN YOUR WORKSHOP**

*No other drill like it!* ⅜" Jacobs geared chuck handles big jobs easily, yet drill is lightweight—easy to handle. Change speed in a jiffy. 3000 RPM for drilling thin metal and wood . . . 1000 RPM for thick metal and wood, plaster and masonry. Handles every job at the correct speed—polish, sand, grind, wire brush, mix paint, drive screws—you name it. $29.95

**NEW...AND EXTRA SPECIAL!!**
**WEN ROTARY SHAVER**

A really BIG shaving head to cover large areas and provide a super-fast shave in addition to traditional rotary comfort. Domed shape fits the contour under the chin. Hollow-ground self-sharpening cutters working close to the outer edge make upper lip shaving a cinch. It's the fastest, smoothest, lightest, quietest shaver on the market. $19.95

TRATED, PLAYBOY, ESQUIRE, POPULAR SCIENCE, POPULAR MECHANICS.

POPULAR SCIENCE
REG. U.S. PAT. OFF. Monthly

# The '62 Cars Inside and Out

YOU have to look close for styling changes in the 1962 crop from Detroit, but under the hoods—*wow!* It's a big year in the engineering department. There are three new-from-the-block-up engines (including such surprises as a four and a V-6), expense-saving refinements in cooling and lube systems, and a brand-new brand: the middle-size compact Chevy II.

## Here's the full report in 30 pages of facts and photos

It's a V-6—first engine of this type ever to power a U.S. passenger car—for the Buick Special ..... 66

Chevy II, sized between Corvair and Chevrolet, comes in with a four-banger (there's a six, too) ..... 68

Details make the styling news. You see the 1962 look in full-color close-ups of 20 makes ..... 70

A light that shines around corners? A real emergency brake? Here are the gimmicks for '62 .... 72

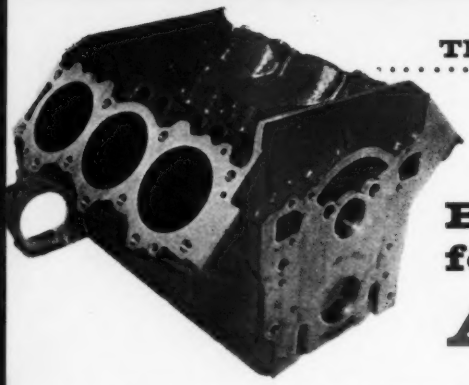
Tricky engineering makes radical engines that give superhighway power while saving weight and fuel ..... 74

The new Ford goes two years between water stops. Are cars that never need service on the way? ..... 78

A POPULAR SCIENCE driver gives the V-6 engine a real workout—across the West and up Pikes Peak .... 82

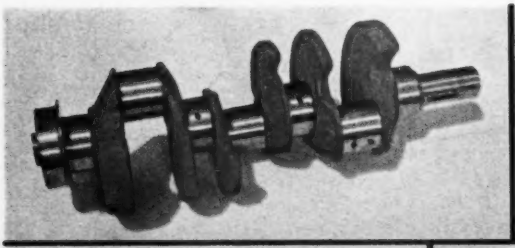
What's it like to drive the '62s? Here's the lowdown, in a report from the driver's seat ..... 85

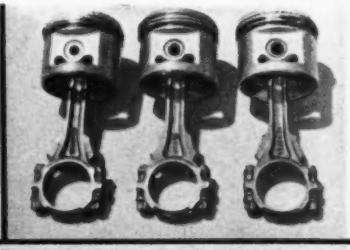
The automobile manufacturers answer back on safety design: Why we *do* make cars safe ..... 89

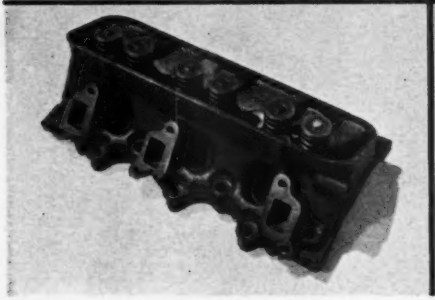


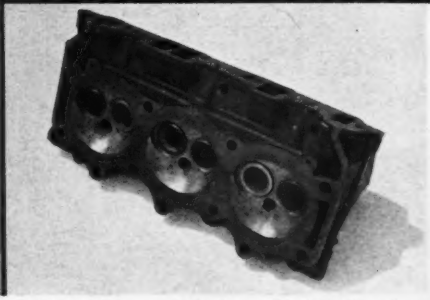
# Brand-New Engine for Buick:

# A Cast-Iron

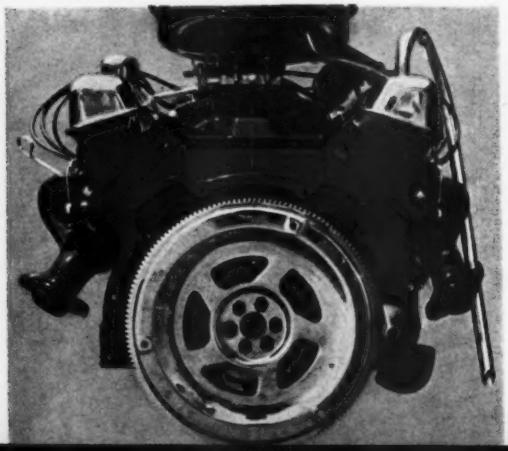








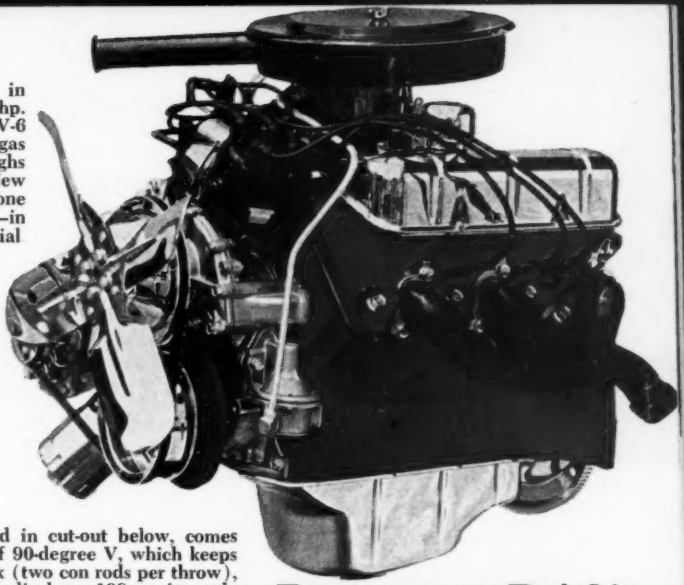
**DETROIT'S STRANGEST SIGHT FOR '62** is an engine block with three cylinder holes per bank (top of page). V-6 block is only 16 in. long, 12 in. wide, 17 in. high. Photos just above show 18¾-in.-long crankshaft, which has four bearings (V-8 has five); three of six pistons; top of head with its exhaust porting; slanted-saucer design used for the combustion chambers.



**FLYWHEEL** in automatic-transmission version is a lightweight five-pounder only because transmission behind it smooths out the uneven power pulses. With manual shift, same engine requires 35 pounds of flywheel to compensate for irregular firing. (For comparison, the aluminum V-8, which fires regularly, spins a 21-lb. flywheel.) Only other V-6 engine produced in the U.S. powers some GM trucks; it has 60 degrees between banks and a six-throw crankshaft.

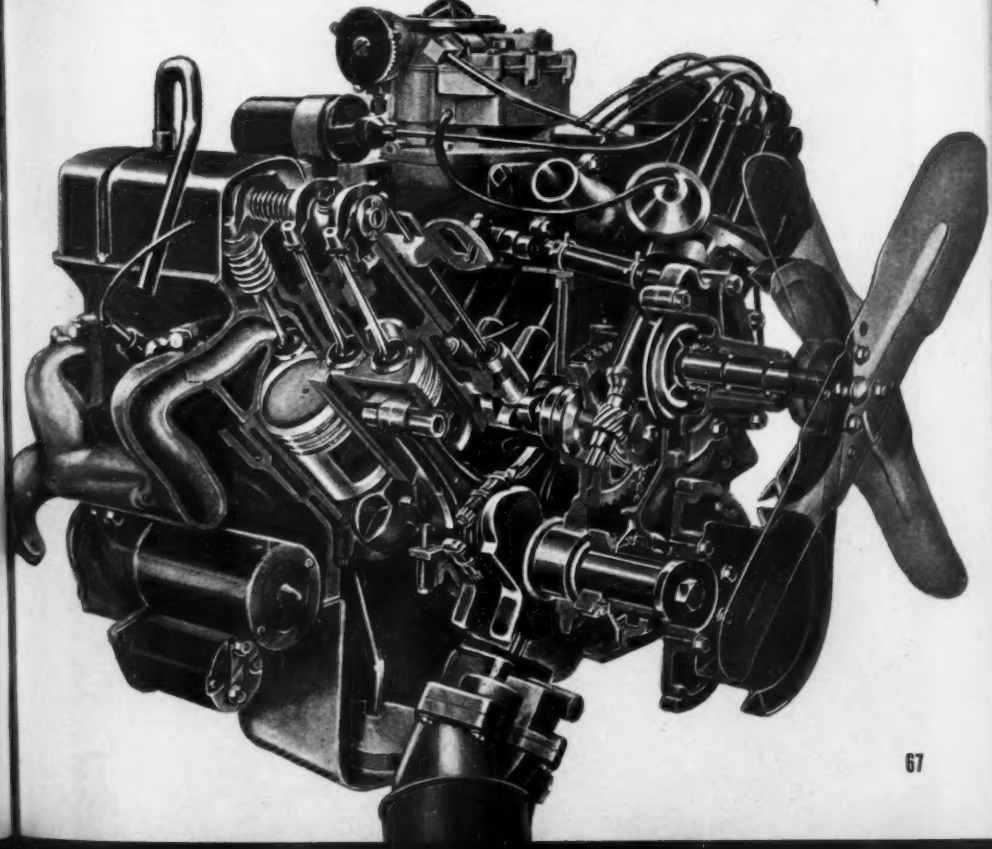
**135-HP. V-6 IS STANDARD** in '62 Buick Special, with 155-hp. aluminum V-8 optional. V-6 will deliver slightly better gas mileage than V-8. It weighs around 50 pounds more. New engine was produced in one year—half the usual time—in push to cut basic cost of Special

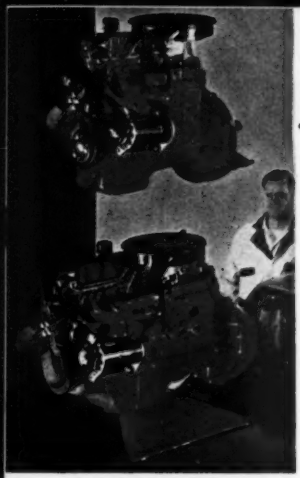
# V-6



**COMPACT DESIGN,** illustrated in cut-out below, comes from unusual combination of 90-degree V, which keeps it low, and three-throw crank (two con rods per throw), which keeps it short. Engine displaces 198 cu. in., only 17 cu. in. less than aluminum V-8. Bore is 3.625 in., stroke is 3.2 in. Aluminum V-8's: 3.5 by 2.8 in.

**For more on Buick's V-6, see p. 74**





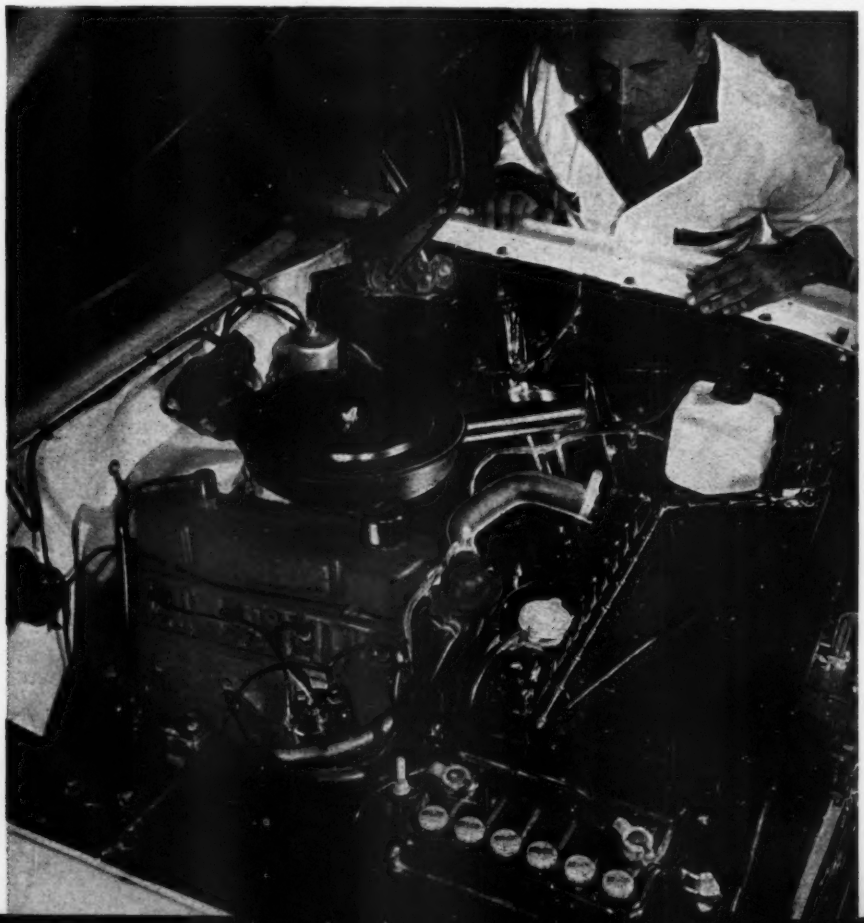
**ONE BASIC DESIGN** with many shared parts makes two economy engines: 90 horsepower from four cylinders or 120 from six.

The '62 Cars Inside and Out

## Pair of New Engines:

# Chevy II's Four and Six

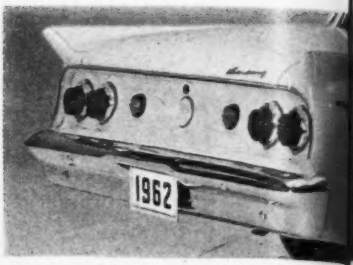
**WHERE'S THE ENGINE?** Like a two-year-old's foot in daddy's shoe, tiny four is nearly lost inside compartment dimensioned to hold six-cylinder version. With radiator set way back, a big "doghouse" shroud is needed to funnel air from the grille. The accessibility should make life easier for Saturday mechanics. Chevrolet hadn't made a four-banger since back in ancient times—1928, when a 487-lb. hulk wheezed out all of 35.5 hp. The new four gets nearly three times as many horses from a mere 360 lb., a weight reduction of 25 percent.



**OVERSQUARE DESIGN**—larger bore than stroke—reduces engine friction. Stroke is the same on both versions, but four (above) has larger bore (3.88 in.) than six (3.56 in.). Other details follow standard practice: overhead valves with hydraulic lifters, cast-aluminum pistons, wedge-shaped combustion chambers, a small single-barrel carb. Four-cylinder engine should enable Chevy II to approach fuel economy of Corvair, despite latter's size and weight advantage. The compression ratio is 8.5:1.

**FIVE MAIN BEARINGS** instead of standard three seem extraordinary luxury for economy job. One rumor: This unusual sturdiness will be put to use later by addition of a supercharger.

**For more on the new engines, see p. 74**

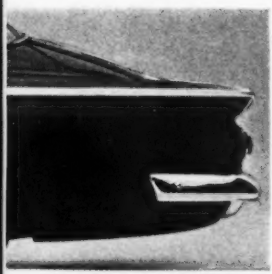



**COMET'S** higher trunk lid is squared off above lip. Clustered tail lights replace oval ones.

**CHEVY II** (center, left) is distinguished from other Chevrolet cars by size. It is 183 inches long, compared with Corvair's 180 inches (top) and standard Chevrolet's 209.6 inches overall (bottom).

## The '62 Cars Inside and Out

# The New Look



**VALIANT** has lost that dummy spare-wheel impression in the deck lid.

**FORD** runs a wider chrome spear from prow to stern. In another styling change, bulges at rear quarter panels have been removed.

**MERCURY** is easy to spot. Cone-shaped tail lights are in chrome scoops.

**OLDS F-85** brand name has been raised from grille to lip of hood. Moldings are higher.

**BUICK** backup lights are inboard of tail lights. Deck lid bears a chrome-plated "wind split."

**TEMPEST** has undergone minimum changes. Its slanted fins are now brightened up with chrome.

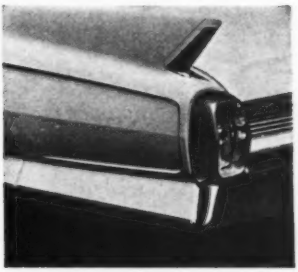
# on the Road

**DODGE** has gone to Lancer-type rear sheet metal, with chrome decoration.

**CHRYSLER** tail lights climb up over a vestige of 1961's prominent fins.

**PLYMOUTH** drops fender "wings," adopts simpler concave grille with two headlight insets.

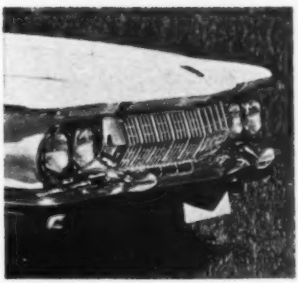
**PONTIAC** uses two big half-moon clusters to replace the oblong tail lights of last year.



**CADILLAC'S** lowered fin lights up; indentation in sheet metal rounds off short of tail light.

**OLDSMOBILE** moved oblong brightwork from behind headlight to door.

**STUDEBAKER LARK** grille is overlaid with egg-crate pattern. All models have four eyes.



**DODGE LANCER** has a new, convex grille, but body lines are unchanged from last year.

**BUICK SPECIAL** tail lights wrap around, and rear sheet-metal panel is more simply sculptured.

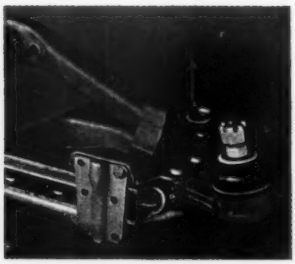
**FALCON** sports a Thunderbird-type fake air scoop on hood, a grille with vertical lines.

**HAND-RAISED TOP** for convertibles is back. Bright idea is to save money—no electric motors, hydraulics, or pushbuttons, just big coil springs on the levers. One puny girl can handle the spring-assisted top, they say. Cost-conscious design might bring price of this Buick Special convert below Chevrolet's.

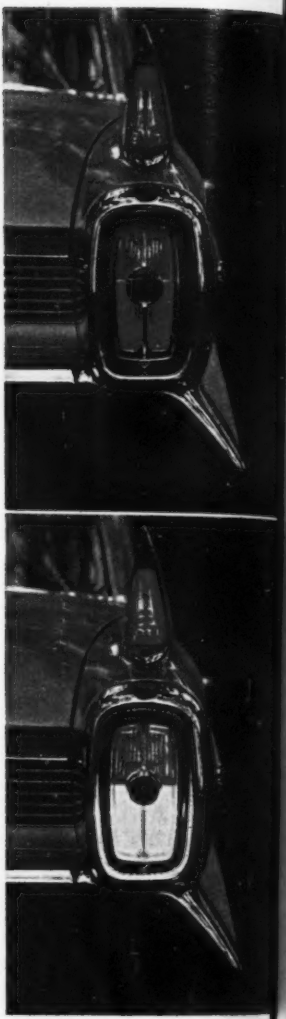
### The '62 Cars Inside and Out

# Bright Ideas in the New Cars

**HOT?** Try Oldsmobile's split-level air-conditioner outlets. Above the customary nozzle is a separately controlled, smaller auxiliary outlet to direct cool air straight at your face. You just pull the button for a quick cooling off.

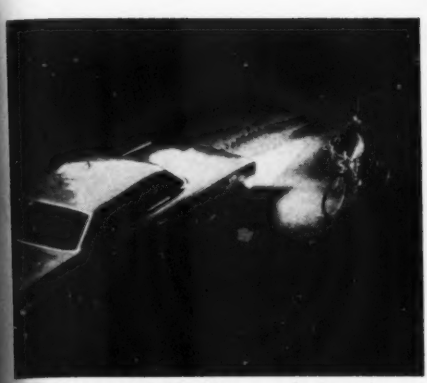


**NO GREASING—FOREVER.** This bit of machinery marks the end of an era. Using larger sealed cup provides life-of-the-car lubrication for ball-joint suspension. Oldsmobile now has eliminated all chassis greasing points.



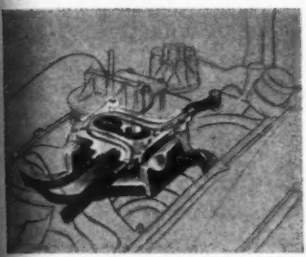
**TRICKS WITH LENSES** make Caddy back-up lights double as tail lights. Outer lens is clear (except for reflector button), shows all white in day. Tail light bulb has red filter; when it alone is on, entire lens glows red (top). With back-up light also on, it comes through bottom half of lens white; tail light keeps top red (lower photo). Unchanged fin light has red lens.

**STICK HYDRA-MATIC.** If you want the sports-car look without marching through gears, Olds offers floor-mounted automatic-shift lever.

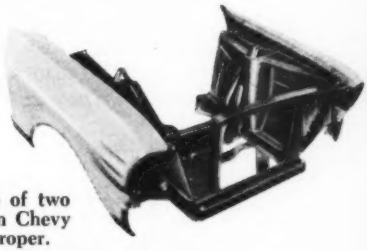


**LIGHT TURNS CORNER:** You see where you're going to go with Cadillac's around-the-corner lights that shine at 45 degrees to the side of the straight-ahead headlights. They work off the turn signal when the headlights are on.

**YOU COULDN'T FORGET YOUR SEAT BELT** if this experimental accessory, developed by Chrysler, were adopted. Wired through clasp, belt carries a low-voltage current that flashes a red light under dash when the belt is unfastened.

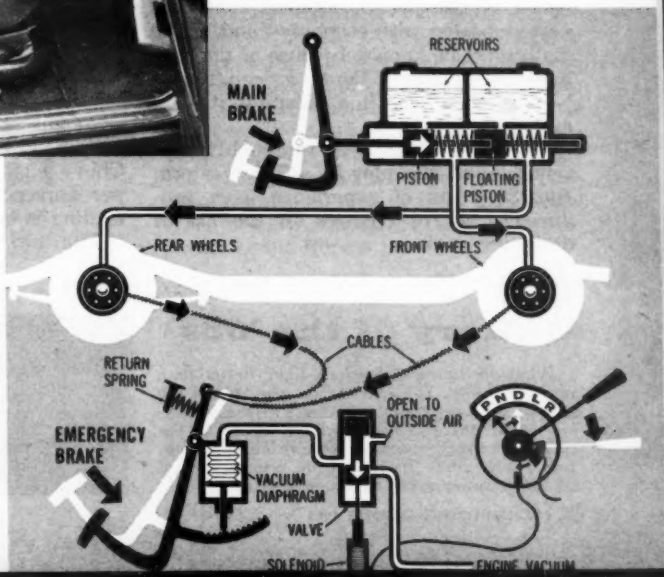


**FASTER WARMUP** on Merc is gained by using hot water as well as exhaust heat to warm intake gases. Water is routed through passage in carb mount. Exhaust crosses manifold.



**UNITIZED FRONT END,** one of two basic body substructures in Chevy II, bolts firmly to body proper.

**DO-IT-YOURSELF POWER SEAT** is an option in Rambler American. Right front seat can be raised or lowered by pumping handle. Hydraulics do it.




**TRIPLE-SAFE BRAKE SYSTEM** for Cadillac consists of three separate parts that can be used independently of each other. It's a real Rube Goldberg—except that it works beautifully. Hydraulic brakes have two, not one, fluid reservoirs. If either loses fluid, the other one actuates front or rear brakes. If hydraulics fail completely, parking brake serves on highway. Its locking ratchet, which would prevent road use, is disengaged when transmission selector lever is set for driving.

# What's New

BACK in 1928 the Chevrolet Motor Division closed its production line on a famous family of four-cylinder engines and went to sixes. Last month it announced a shocker—a return, after 33 years, to four cylinders in a new economy car.

Chevy's new overhead-valve four for '62 is the biggest single piece of news about automobile engines to come out of Detroit in a month of unveilings of the 1962 products. But there is other lively engine news, too:

• Buick has produced the first mass-output V-6 engine for a passenger car in the history of U. S. automobile manufacture. Ninety degrees separate its two banks—an oddity in itself. The engine is spunky. It's also a maverick—the cylinders do not fire at regular time intervals. They gallop.

## That new Chevy four

WHY in the world did Chevrolet decide to produce a four-cylinder car after all these years? The answer: Because of the U. S. motorist's current preoccupation with economy (and, if the truth must be known, because of the runaway popularity of Ford's Falcon, miserly with its gasoline despite its six cylinders).

The Chevy four is as thoroughly conventional as the plot in a TV Western. But 33 years of experience have produced a lot of changes in the art of designing engines.

Take a look at these comparisons:

| | 1928 CHEVY 4 | 1962 CHEVY 4 |
|---|---|---|
| BORE | 3.688 in. | 3.875 in. |
| STROKE | 4.0 in. | 3.25 in. |
| DISPLACEMENT | 194 cu. in. | 153 cu. in. |
| COMPRESSION RATIO | 4.4:1 | 8.5:1 |
| HORSEPOWER | 35.5 @ 2,200 r.p.m. | 90 @ 4,000 r.p.m. |

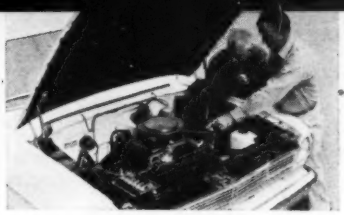
***The march of time.*** Here's proof of what has happened to engines and fuels in the last three decades: The 1928 Chevy engine toted 73.2 pounds of car per horsepower; the 1962 Chevy four's loading is only 27.8 pounds.

The new Chevy overhead-valve six,

## Gallery of the '62s

**What do the new cars look like? Better than ever, naturally. You can see for yourself in the gallery of photographs on this and the following seven pages. Two trends: a swing to the rectangular roof line pioneered by Thunderbird, and a big range in size, from truly compact compacts to luxurious dreadnoughts.**

FORD



# Under the Hood

• Chevy has not only a new four but a new, lightweight in-line six as well. Both power plants are tailored to the chrysalis-fresh economy car, the Chevy II.

• Like teenagers afflicted with growing pains, some of the second- and third-generation compact cars appearing for '62 are—perhaps inevitably—slyly nudging upward in their horsepower offerings.

• A few of the bigger cars have power plants so muscular that they abuse the credulity of the motorist. One promises no less than 409 horses.

Significantly, none of the new engines is built around an aluminum block. Cast iron is cheaper, and new manufacturing techniques have made possible thin-walled blocks without sacrificing sturdiness. So the weight advantage of aluminum is partly discounted.

optional in the II except for a fancy-pants model called the Nova where it's standard, is just as conventional as the four.

The regular Chevrolet six engine used in the big Chevrolets—a power plant so old in design that the memory of man runneth not to the contrary—was not considered for the new car because of its weight.

Here's how the two stack up:

| | NEW CHEVY 6 | REG. CHEVY 6 |
|---|---|---|
| BORE | 3.563 in. | 3.56 in. |
| STROKE | 3.25 in. | 3.94 in. |
| DISPLACEMENT | 194 cu. in. | 235.5 cu. in. |
| COMPRESSION RATIO | 8.5:1 | 8.25:1 |
| HORSEPOWER | 120 @ 4,400 r.p.m. | 135 @ 4,000 r.p.m. |
| WEIGHT | 450 lb. | 608 lb. |

Chevy's 1929 six, by the way, produced 46 hp.

The bigger Chevrolet six will continue as an option for economy-minded buyers of full-size Chevrolets.

A sharp eye will discover something fishy in the list of specifications on the two new engines. Detroit does nothing by happenstance. The four-cylinder engine has five main bearings, two more than actually necessary. The six has seven main bearings, again two more than necessary. It's common gossip that Chevy is prepared to supercharge both these engines in 1963 or 1964 with a new type of blower spun by exhaust gases. [See Detroit Report.]

PLYMOUTH

PONTIAC

CONTINUED

# Buick's odd-ball six

ALTHOUGH Chevy's engine news is the biggest for '62, Buick's—mechanically—is the most interesting.

The basic facts on Buick's V-6 are simple. The engine, of cast iron, displaces 17 cubic inches less than the tidy aluminum V-8 in the compact Special.

The comparisons:

| | V-6 | V-8 |
|---|---|---|
| BORE | 3.625 in. | 3.5 in. |
| STROKE | 3.2 in. | 2.8 in. |
| DISPLACEMENT | 198 cu. in. | 215 cu. in. |
| COMPRESSION RATIO | 8.8:1 | 8.8:1 |
| HORSEPOWER | 135 @ 4,600 r.p.m. | 155 @ 4,600 r.p.m. |

A V-8 with 10.25:1 compression ratio, producing 185 hp., is an option.

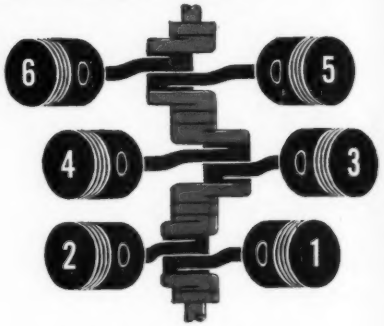
Buick has a straightforward reason for wanting a V-6: A cheaper engine would help reduce the price of the Special. But the background and design of this engine are anything but straightforward. Questions abound:

A V-6 by nature is a cantankerous piece of machinery. Why not a cylinders-in-line six, like Chevy's, proved by time? One answer to that is space. The Special's engine compartment was constructed for a V-8 block 20½ inches long. An in-line six would have had a block more than 28 inches long. Moreover, a V-6 would be lighter.

Another answer is that the V-6 would use a good many of the aluminum V-8's parts—valves and springs, timing chain, flywheel housing, and so on. The aluminum V-8 also has cylinder banks separated by 90 degrees.

That also answers part of the next question: Why a 90-degree six? Again, space. A lesser distance between the two banks—60 degrees, for example—would bang the hood against the engine.

With an aluminum V-8 in being, why go to a cast-iron V-6? Why not just lop off two of the V-8's cylinders as a switch on Pontiac's scissoring off one bank of its V-8 to create a four-cylinder engine for the Tempest? The answer: Cast iron is easier to work, a cast-iron engine easier to produce.




### How the V-6 works

**Pistons are numbered from front of engine. Three throws, each taking two connecting rods, are positioned around crankshaft 120 degrees of a circle apart. Firing order is 6-5-4-3-2-1.**

**Drawings A through D, illustrating sequence of firing and stages of pistons, show only four of the pistons. Remaining two merely repeat cycles described.**

**Drawing A: Piston 6 is firing; 5 is on compression stroke; 4 is finishing intake stroke; 3 is starting intake.**

**Drawing B: Piston 5 is firing 90 degrees of crankshaft rotation after 6; 6 is on power stroke;**

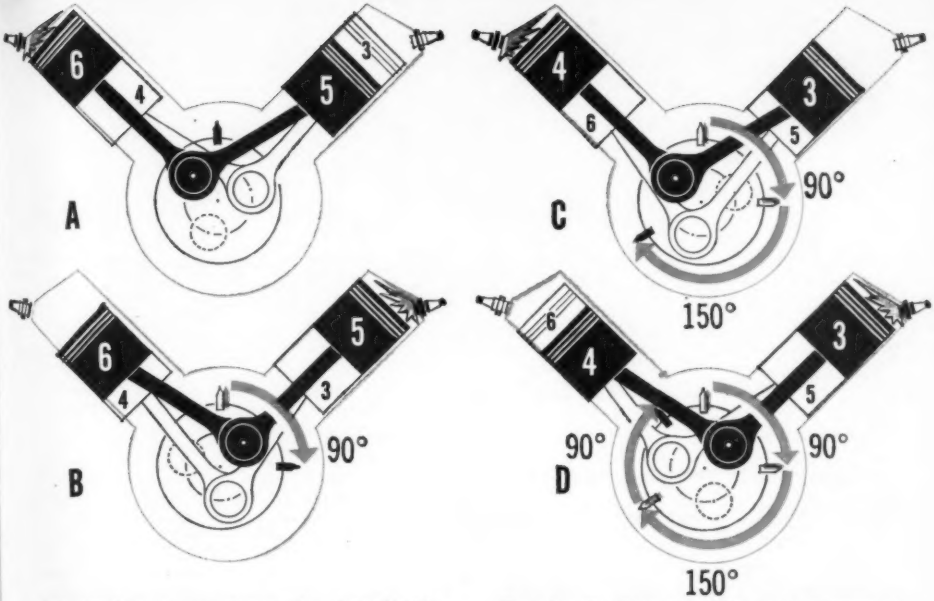
***Not so cranky.*** The crankshaft has three throws, each taking two connecting rods. Why not six separate throws? Once more, space. Three throws make a shorter crankshaft.

Those three throws were the problem. It's not impossible to build a six-cylinder engine with three instead of six throws, each taking two con rods, with equally spaced firing intervals. But then the cylinders have to be in two banks spaced 120 degrees apart. Only with this ar-

## Gallery of the '62s

TEMPEST

COMET




4 is starting compression stroke; 3 is finishing intake stroke.

Drawing C: Piston 4 is firing 150 degrees of crankshaft rotation after 5; 3 is on compression stroke; 6 is on exhaust stroke; 5 is completing power stroke.

Drawing D: Piston 3 is firing 90 degrees of crankshaft rotation after 4; 4 is on power stroke; 6 is finishing exhaust stroke; 5 has started exhaust stroke.

Piston 2, not shown, will fire 150 degrees of crankshaft rotation after 3.

rangement of the two banks can the pistons of a three-crank engine be brought to top dead center at equally spaced time intervals.

But a V-8 banked at 120 degrees is wide. For the Special, that was out.

The new V-6 would have to have uneven firing intervals—the power pulses delivered to the flywheel would not be evenly spaced. There was precedent. One version of the old, flathead, 60-degree Lincoln V-8 pulsed irregularly.

Buick's spasmodic-firing V-6 works fine. It's only 50 pounds heavier than the aluminum V-8. It's a six that thinks it's an eight—its horsepower and torque are outsize for its displacement, compared with an in-line six.

## Horses, horses, horses

AS FOR the remainder of Detroit's engines for '62, let's look first at the compacts: They are edging up in horsepower. The Chevy Corvair came out two years ago at 80 hp. For 1962, 102 hp. is an option. Both the Olds F-85 and the Buick Special began at 155 hp. During the '61 model year, both shot up to an optional 185.

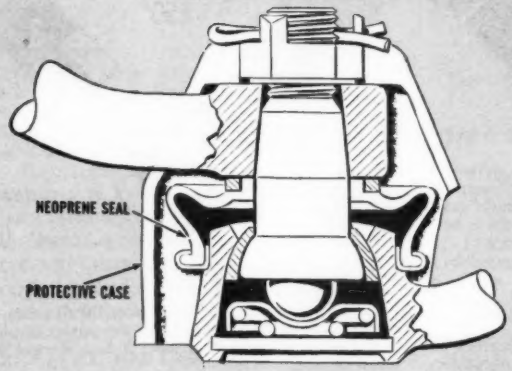
[*Continued on page 216*]

RAMBLER AMERICAN

VALIANT

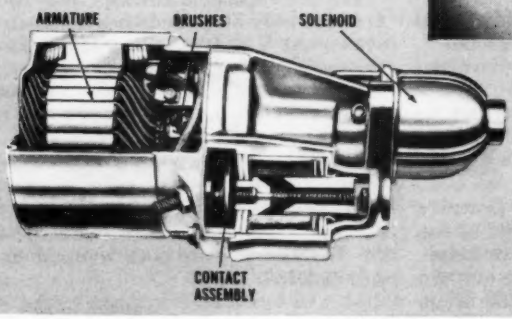
## The '62 Cars Inside and Out

# What's New in Engineering




**MISERLY WITH GREASE,** Dodge's new ball joint is typical of auto industry's move to extend time between lubings beyond 30,000 miles. It's merely a matter of providing more grease, sealing it in—and sealing out dirt and water. An artificial rubber, neoprene, acts as both container and sealant. Plugs replace conventional grease fittings. Barium-base lubricant, developed by oil industry, is especially pressure-resistant, doesn't squeeze out.

**WHAT, NO LEAVES?** New rear springs of Chevy II (right) consist of a single steel bar. By eliminating leaf friction, they help to reduce vibration.

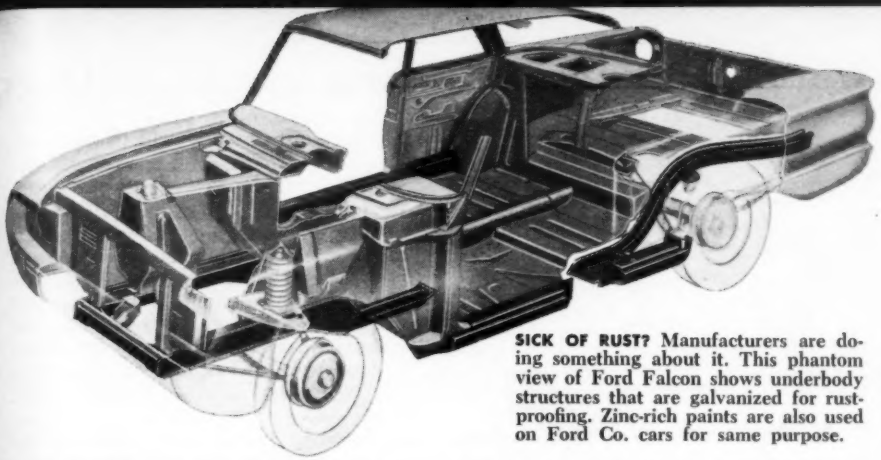



**NO-WHINE STARTER** is on all new Chrysler Corp. cars. Ignition key causes solenoid to mesh drive pinion with flywheel ring gear. Engine is cranked at a 45:1 ratio —more than twice the ratio of a direct-drive starter—for a greater torque. Overrunning clutch keeps the motor armature from overspeeding.

## Gallery of the '62s

FALCON

OLDSMOBILE



**SICK OF RUST?** Manufacturers are doing something about it. This phantom view of Ford Falcon shows underbody structures that are galvanized for rust-proofing. Zinc-rich paints are also used on Ford Co. cars for same purpose.

WHEN Detroit's auto makers yanked the shrouds off their 1962 hardware last month, as eager to please as street merchants in the Casablanca casbah, they breathlessly awaited the public's response to engineering improvements like these:

- A radiator ant'freeze labeled as "permanent" (which it isn't, but still and all more permanent than those things a woman gets at a beauty shop).
- More optional four-speed manual transmissions—belated recognition that lots of motorists love an automobile as an exquisite piece of machinery, not as a self-driving gimcrack.
- A dash utility socket that will deliver electric power to practically anything from portable refrigerators to bottle warmers and bottom coolers.
- A trick auxiliary headlight to guide a car around a corner.
- An automatic choke that won't spill raw gas into cylinders when not needed.

Almost without exception, however, manufacturers passed over their juiciest morsel of industry-wide news: At long last the day of the permanently lubed automobile seems definitely at hand. On two cars it's actually here—buy them and forget about trips to the grease rack.

The back-of-the-hand treatment that Detroit accords permanent lubing for '62 may be deliberate; to underscore it would be to admit that the permanently lubed car could have been built years ago. Take the rear axle, for example. How often have you added grease? The filling-station man unscrews the plug, sticks in an exploring finger, grunts, and replaces the plug.

Pressed for an explanation as to why the axle of his car had been so tardily given permanent lubrication, the engineer of one company admitted. "We didn't take the trouble before this to seal in the lubricant."

For '62, conventional chassis lube fittings are eliminated on all Chrysler Corp. cars. Front-suspension ball joints, steering linkages, and clutch torque-shaft bearings have a lubrication interval of 32,000 miles instead of the former 2,000. Tie-rod ends are sealed for the car's life.

The only now-and-then attention Chrysler Corp. suspensions require is inspection of seals for damage from road debris kicked up by the tires. Relubing requires the removal of plugs.

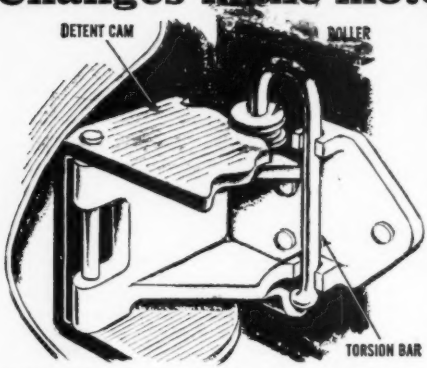
Ford Motor, paced the field last year by equipping its full-size cars to go 30,000 miles between lubes. For '62, front-wheel

LARK

F-85

CONTINUED

# Changes make motoring easier, quieter,




**EASY DOES IT:** Torsion-bar hinge, combined with a new cam-and-detent for door-check roller, makes Dart doors open more easily. Door checks will hold even in moderate wind.

bearings need no grease for the same amount of driving.

Pontiac's lube interval on its full-size cars is boosted from 3,000 to 35,000 miles. Moreover, with a reservoir-and-wick system, the distributor bearings never need oil. You still have to oil the cam lobes, though.

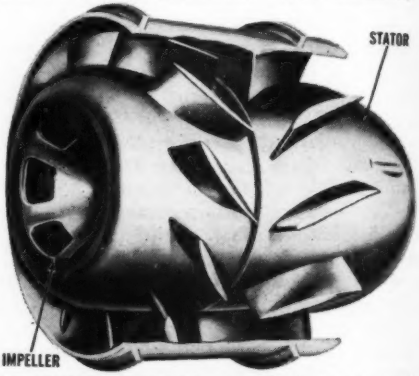
The big Olds joins Caddy with lubrication for the life of the car. Two years ago the Olds had no less than 19 front-end lube fittings. Last year that was reduced to four—just the ball joints on the suspension. Now the fittings have been sheared even from those. And add Olds generator and distributor bearings to the forget-it list.

Oil changes? Ford's full-size cars now go 6,000 miles between them. Fuel filters, including those on the Falcon and Comet, need replacement only every 30,000 miles. Plymouth oil changes are recommended now only each 4,000 miles. Pontiac's is the same.

***The small cars.*** Permanent lubing for compact cars other than Valiant and Lancer—which follow the Chrysler Corp. program—undoubtedly will come soon. For now, Detroit is confining this tidbit—for sales reasons—to its bigger cars. Chevrolet and Buick remain exceptions.

That other twist on shrinking service, the "permanent" antifreeze, is on all Ford Motor Co. cars. Poured into the radiator at the factory is the standard permanent antifreeze: ethylene glycol diluted with water and some inhibitors. It's good to 30 below zero for two years or 30,000 miles, whichever comes first. No change was required in the radiator, but, because glycol leaks through the tiniest holes, the hoses were lined with leak-resisting butyl rubber. For the same reason, better connections and cap were designed. New cars are supplied with the antifreeze, whether destined for Yuma, Ariz., or Point Barrow, Alaska.

After more than a decade of hawking the automatic drive as the quintessence of motoring pleasure, auto makers are adding to more cars that sublime option, the fully synchronized, floor-mounted,



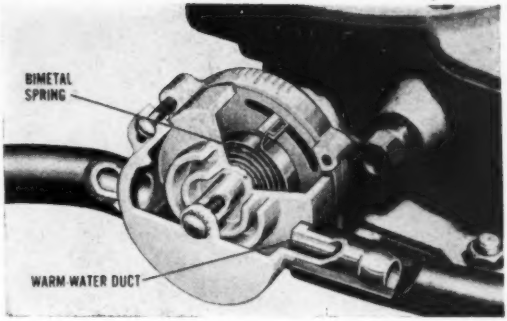

**AXIAL-FLOW BLOWERS** move air for heater and air conditioner on Chrysler Corp. cars. Like jet engines, blowers have impellers and stators, pump up to 225 cubic feet of air a minute.

## Gallery of the '62s

DODGE

BUICK SPECIAL

## more economical




**SAVE MONEY:** Ford Motor's Continental has come up with a solution to the too-much-choke problem. Exhaust-manifold heat normally is used to relax choke after cold starts. But in restart, after a short drive, quickly cooled exhaust rechokes although engine is still warm and ready to go. Remedy is to duct warm water from engine jacket through choke body. Acting on bimetal spring, it prevents the pouring of raw gas into cylinders that have no need of it.

four-speed manual-shift transmission.

The additions are Buick Special and Ford Galaxie. Chevy, Olds, Pontiac, Corvair, and Corvette had it earlier.

Detroit is getting the message on this option late. No one was more surprised than the Chevrolet people when, after restoring the fun to driving by putting four speeds in the Corvair box, they couldn't keep up with orders.

***New eye-catchers.*** The all-purpose dash utility socket belongs to the Dodge Dart. Tape recorders, spare radios, electric razors, extension lights, fans, vacuum cleaners? Just plug them in. That bottom cooler probably needs an explanation. It's an upholstery pad equipped with an electric blower to circulate breezes though the seat on hot days.

The trick auxiliary headlight is Cadillac's. It shines to the side at 45 degrees if the turn signal is on (photo on p. 73).

The new water-warmed choke is Lincoln's. Most chokes relax when warmed by hot air from the exhaust manifold. But in short-stage driving, the manifold cools fast. When the engine is fired up after a stop, the choke chokes even though the cylinders are still warm. Result: gas uselessly burned, engine wear, an annoying fast idle.

Lincoln pipes water from the engine jacket to the choke. The choke reads the water temperature—a more reliable index to engine temperature than the exhaust manifold. This, by the way, is a separate system entirely from Mercury's water-heating of the incoming fuel-air mixture for the cylinders.

***New springs.*** The Chevy II has single-leaf rear springs, giving a softer ride as there are no leaves to induce friction.

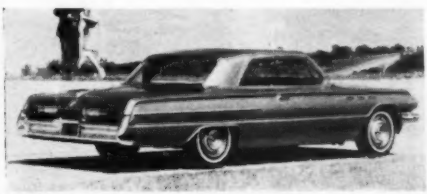
Studebaker frame, suspension, and drive-train engineering had to accommodate a whole new look in the Lark. All the two-doors and the Cruiser are longer by nine inches, the four-door sedans by 13 inches, and the station wagon by 2½.

Dodge and Plymouth engineers, on an opposite tack, shortened the frames of their vehicles to accommodate a uniform overall length of 202 inches. Dodge's Polara—frankly fashioned for '62 to compete with Ford's Thunderbird—had been 212 inches long, the Dart 209.4 inches, and the Plymouth 209.5. For comparison, the new standard Chevrolet and Ford continue to reach beyond 209 inches.

Rambler's self-assertive little American offers five—that's right, five—different transmissions or transmission combinations: 1) a conventional box; 2) the same thing with overdrive; 3) an automatic;

*[Continued on page 232]*

LANCER



BUICK

*Brother, it's cold up here. Hurry up and snap that shutter so we can get going.*

**The '62 Cars Inside and Out**

# Wringing Out Buick's New V-6

***Across the plains, through the Rockies, and up Pikes Peak . . . 2,000 miles behind Detroit's newest engine***

**By Hubert Luckett**

"WHADDA y'know, a V-6." The leathery-faced gas-pump wrangler pushed back his 10-gallon hat, hung a high-heeled boot on the bumper, and squinted knowingly into the engine compartment. He would have seemed more at home looking into the mouth of a quarter horse.

*Monument (background) near Lebanon, Kans., marks geographical center of U. S. Claim is clouded now by new states.*

*I wonder if the Pony Express riders had as much trouble with bugs. As I followed their route west from the Mississippi, this bug-cleaning was about the only exercise I got. Road stretches straight as a string from horizon to horizon.*

He grinned. "I bet you boys are testing next year's models. I seen V-6s in Jimmies [GMC trucks], but they're 60-degree jobs. This one's a 90. Must be a whole new engine."

It was a shrewd guess. A more unlikely place and person to make it would be hard to imagine. We had stopped at a lone, street-side gas pump in the old mining town of Cripple Creek, high in the mountains of Colorado. In the 1,600-odd miles we had driven since leaving Flint, Mich., Buick's home town, half a dozen service-station attendants had checked under the hood—without comment.

Late last July, I pulled away from the curb in front of the Durant Hotel in Flint behind the wheel of an ordinary-looking '61 Buick Special. But only the sheet metal was '61. Under the hood was one of the first V-6 passenger-car engines built in this country. It was No. 9 off the pilot production line. This was to be the standard power plant in the '62 Buick Specials.

***Tough test.*** In the next six days and 2,000 miles I was to give it the most punishing kind of driving I could find. I knew the development program had been much shorter than usual for a brand-new engine. If there were shortcomings, I wanted to find them.

My traveling companion was Ralph

*A switchback on the road up Pikes Peak. The camera can lie—that road wasn't nearly that wide when I drove up.*

*Mother and child slowed us down on the old Gold Camp Road.*

*Jonah would feel at home in the inky darkness of this old narrow-gauge railroad tunnel. Termites aren't welcome.*

CONTINUED

*The sign's not kidding about road conditions. And a cloudburst the day before didn't improve them any—but still we made it.*

*Although I was supposed to be interested only in the engine, I was grateful for the Special's excellent handling and brakes before I was through.*

Dean, from Buick's Experimental Engineering Group. His confidence in the engine was a little uneasy-making. He didn't even bring along a screwdriver —much less spare parts.

We headed southwest out of Flint. By the time we reached the outskirts of town, a nagging thought nibbled the back of my mind.

"Are you sure they didn't make a mistake and give us an eight?" I asked Ralph. I hadn't opened the hood before we left. The way this baby got away from lights and zipped around slow-moving trucks was like no compact six I had driven.

"No mistake. It's a six," he said with a grin. "I checked the oil myself when I topped off the tank this morning."

We hummed along the open highway at 65 and 70 as the speed limit permitted. At 70 the engine still seemed to have plenty of ambition. On a deserted straightaway, I found out how much. I pushed the pedal to the floor and the needle climbed to 90 without hesitation. It drifted on up to 96 before a car showed up on the horizon and I backed off.

Our first refill was at Michigan City, Ind. The odometer showed 277 miles since we started. It took 11.7 gallons. Not bad—19.4 m.p.g., and the way I had been driving would never win an economy run.

***Absorbing the vibration.*** With the engine idling while I waited for change, I was reminded that some roughness at idle was supposed to be unavoidable in this design. It took concentration to detect it from the driver's seat. But when I lifted the hood, the engine was bobbing like a nervous thoroughbred on tight rein. They cope with the problem by extra vibration absorption in the engine mounts and a fairly high specified idle speed (575 r.p.m.). At speeds above idle, you are never aware that the engine fires in

[*Continued on page 208*]

*We were there. That's Pikes Peak in the center of the picture. Road up wanders out of the picture on the right, zigzags back along the high ridge and up the face you see here. Buick's Ralph Dean provides human interest.*

# What They're Like to Drive

**By Alex Markovich**

*Dart TorqueFlite pushbuttons are within easy reach. Trouble is, you can't shift without looking, as with a column-mounted lever.*

NARROW back-country roads, muddy and rutted cowpaths, straight-as-a-rule concrete expressways—I tried 'em all in the driver's seats of Detroit's '62 offerings.

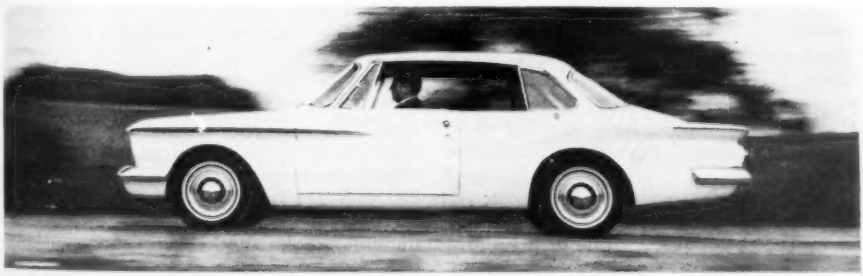
Most of my driving was done behind proving-ground walls. But within these grounds are duplicated all the road surfaces you're likely to encounter anywhere in your motoring—chuckholes, tar strips, water traps, 30-percent grades.

Before I share my impressions with you, one word of warning: I'm a sports-car buff. I like wind in my face, a brain-addling ride, and a floor-mounted joy stick. So don't be too concerned if I sputter a bit about idiot lights, power ash trays, and marshmallow suspensions.

***An all-new Chevy.*** The Chevy II, Chevrolet's new from-the-ground-up "super-compact," left me cold when I first saw it. Not very exciting looking, I thought. Conservative styling. Obviously bread-and-butter transportation. Kind of cute, though. Except for those blasted 13-inch kiddy-car wheels.

The engine compartment proved roomy. Spark plugs, distributor, battery, and other frequently serviced components were easily accessible, as you'd expect with an in-line engine.

The big surprise came when I opened the door and slid behind the wheel. The car suddenly grew three feet—or seemed to. Leg room was ample. Lots of head room, too (the Chevy II is only a half-inch lower than the full-sized Chevrolet.) Elbow room was fine for two abreast, but



*Scenery here looks as if it's whizzing by a stationary Valiant—and that's the way it feels in the driver's seat, thanks to the fine, roadable suspension.*

CONTINUED

*Getting the Fury's rear end to break away took some frantic driving, even on a dirt road. Suspension is better than average, but stiffer shocks would help.*

tight when a third person squeezed into the front or back seat.

Interior appearance was neat but not plushy. The circular speedometer with white numerals over a black field was easy to read, but its 120-m.p.h. range was amusingly optimistic. Unfortunately, water temperature, generator charge, and oil pressure are "shown" by idiot lights. The hand brake is hidden under the dash, to the right of the steering column, where it's practically useless in an emergency.

I twisted the ignition key and the little four-banger awoke with a smooth (for a four) purr. I put the column lever in D and rolled away. Upshifts were barely noticeable.

Ahead lay a pock-marked stretch of road: ruts, bumps, tar strips, the works. Pleasant surprise. The ride was a lot smoother and softer than I'd expected from such a small car. The single-leaf rear springs take most of the credit. No friction between leaves, no harsh ride. Another pleasant feature was the low noise level. Unitized construction and effective insulation are responsible.

Barreling through a few tight corners showed that, though the car *rides* as if it were coil-sprung all around, it handles better. Mild understeer, moderate lean, fairly good adhesion. Steering is easy but, at 4.72 turns lock-to-lock, on the slow side. It's no faster with power, unfortunately.

Performance? I clocked a corrected 0-60-m.p.h. time of 21.9 seconds. The Chevy II is undoubtedly one of the slowest-accelerating cars out of Detroit in years; but once it gets rolling, it should hold its own on expressways.

The big selling point: compact-car economy and big-car comfort.

***The sporty Corvair.*** "Isn't the Chevy II going to bite into the Corvair market?" I asked the Chevrolet product-information man. "Two economy cars within one line is a bit unusual."

"The Corvair's going sporty," he answered. "Our advertising will slant it toward people who may be hesitant about owning an out-and-out sports car but would still like an unusual piece of machinery."

We approached the new Corvair, a Monza with bucket seats and four-speed floor shift. It looked almost the same as the '61. Just a few pieces of chrome trim peeled off or tacked on here and there. "The main change is in the engine," the Chevy man said. "Four extra horses."

Climbing in wasn't quite as easy as with the Chevy II. The Corvair stands only 51½ inches high. The bucket seats proved well padded and very comfortable, though they don't provide the lateral support of true buckets found on many imports. One problem immediately became evident: lack of leg room. I'm only five-feet-eight, but I had to push the seat back as far as it could go.

The absence of a floor tunnel is, of course, a welcome space saver. Floor pedals are well spaced, even for my triple Es. The horizontal speedometer isn't as readable as the Chevy II's circular one, but what really made me cuss was the flat expanse of dashboard where last year's manual choke had been. Automation, bah!

The engine started up quickly with a throaty, muted growl. As soon as I pulled

away, the extra power became noticeable. In a light car, four horses make a difference.

The transmission lever is well placed and easy to shift. The throw is short, especially considering the length of the lever, and quite precise. Steering requires little effort (no wonder so many women are driving Corvairs). The brakes are very good, and nose dive is practically nil, even during severe panic stops.

Rear-engine cars usually transmit less noise to the passenger compartment, and the Corvair is no exception.

When driven conservatively, the car handles much like any other small car: a firm but comfortable ride and mild lean on turns. But a frantic corner may frighten the unsuspecting driver. The car's tail-heavy design makes the rear end want to drift out. The savvy driver can control the drift with a light touch on the accelerator.

***Big Chevy is almost unchanged.*** Aside from an external face lift, the full-size '62 Chevy hasn't changed much since the '61. Nevertheless, it's impressive in several respects. First is the luxurious interior trim. The Impala I drove had thin vinyl pleats and button tufting, "wall-to-wall" carpeting, and a padded dash. There's excellent visibility all around.

Unfortunately, the speedometer is still horizontal—much harder to read at a glance than a circular one. On idiot lights, Chevrolet has gone the industry one better. In place of the single red light that signals engine overheating (usually too late), two lights are supplied: the usual red one plus a green one that winks out when normal operating temperature has been reached. It's colorful, anyway.

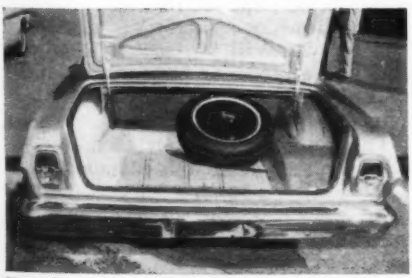
*Thirty-percent grades are child's play for this brawny Galaxie. It's also available with a four-speed box; should be real drag-strip competition for Impala.*

No need to discuss the performance. Chevy has been in the winner's circle at drag strips throughout the country ever since the V-8 made its appearance seven years ago.

My test Impala was equipped with the optional Borg-Warner four-speed manual transmission. I strongly recommend this unit for anyone who likes the feeling of having his car completely under control.

Coil springs all around provide an easy-chair ride over both superhighway and washboard roads. But somehow this isn't in keeping with the high-performance nature of the car. Lean is quite noticeable during even moderate cornering, and tire squeal is annoying. The traditional Detroit understeer is ever present, too. The overall power-steering ratio is a slow 24:1 (5.2 turns lock-to-lock); without power assist it's even slower, 28:1 (5.8 turns).

Just jab that go-pedal on the straight-



*Trunk of Chevy II is more than adequate. Though devoid of carpeting, it's neatly speckle-painted. The guardless rear bumper leaves the sheet metal vulnerable.*

*Bumpy roads are no problem for the Falcon. The ride isn't quite like a Cadillac's, but then neither is the price. Bucket seats are comfortable, well padded.*

CONTINUED

*Rear seat in the Dart offers lots of head room, thanks to the squared-off roof line. Leg room is fair. Luxurious touch on the 440 is front-seat armrest.*

away, however, and you're king of the road!

***Fancy Falcon.*** With narrow-pleated bucket seats and deluxe trim and price tag, the Futura is Ford's answer to Chevy's Monza. Performance is reasonably good, the ride is fairly comfortable, handling is respectable, and gas mileage tops that of all other U.S. makes.

Entry and exit are quite easy, thanks to wide-opening doors. Seating, as in the Corvair Monza, is comfortable, but again lateral support is lacking in the buckets. Narrow pleats allow better breathing and are cooler in the summer than the Monza's wide pleats.

Luggage space is fine, but a high lip makes loading inconvenient. Engine accessibility is excellent. Like most manufacturers, Ford is mounting the battery up front on all its cars for easy checking.

Gauges are readily visible, but a horizontal speedometer plus generator and oil-pressure light are, I feel, unhappy choices.

One of the most noteworthy features of the Falcon is the total lack of road noise. It's undoubtedly one of the best-insulated compacts on the market. First and second gears whined slightly on the standard-shift version, but this didn't prove too annoying. Shift throw is short, easy, and fairly precise.

Steering is moderately slow, and sharp cornering brings out a considerable lean. But breakaway is difficult to induce. Performance, though not breath-taking, is adequate. Equipped with the 170-inch (larger) engine, our test car did 0 to actual 60 m.p.h. in 17.1 seconds with an odometer reading of just under 300 miles. A broken-in engine should do even better.

***The big Sunliner.*** Just my luck! I picked up a sleek '62 Ford Galaxie Sunliner convertible, put the top down, and it began to rain. I put it up again. The latches were tough to engage, but otherwise the operation went smoothly. On my imported roadster it usually takes about 10 minutes to put up the top. In a sudden downpour, I usually get less wet by driving on to my destination.

The interior is roomy, and trunk space is cavernous.

The dash again boasts a horizontal speedo and those abominable blinking lights. But the emergency brake is a definite improvement. Step-on type.

The Galaxie in many ways behaves like the Falcon: soft springing, considerable lean on turns, yet good adhesion. Brakes are effective, but nose dive is noticeable. The ride is quiet. No rattles (unusual for a convertible). No wind noise.

Steering could be speeded up, especially when it's power-assisted, as on our test car.

The big 390 engine obviously had guts. I couldn't resist taking a few 0-60 runs even though the odometer indicated a mere 32 miles.

With the rain still coming down, our best time with the Fordomatic was 10.5 seconds. Wonder what a broken-in engine with the newly available four-speed floor stick would do on a dry road?

***The furious Fury.*** Strange. When I asked manufacturers for test cars, they all seemed anxious to provide me with their hottest models. Guess they'd heard I'm a leadfoot.

The Plymouth was a dilly, a Fury with a big Golden Commando power plant. At the time I asked for the car, movies of it were being taken on an estate outside Detroit. I was allowed to borrow it for a couple of hours of testing.

I tried to pick sparsely traveled roads. The car was still top secret. But every once in a while an unwary motorist drove by, did a double-take, and came around for a second pass.

The equipment for an accurate 0-60 test wasn't available, but Plymouth engineers assured me that a stick-shift model could make it in just over seven seconds. Our Fury, equipped with TorqueFlite, seemed to bear this out.

The transmission shifted smoothly. Only when engaging the kickdown was a mild jerk noticeable. Sometimes, when

***[Continued on page 210]***

# Auto Makers Answer Back on Car Safety

**To the Editor, Popular Science Monthly:**

**The accompanying comments on your September article "Why They Don't Make Cars Safe" is our response to your kind invitation to "answer back."**

**We appreciate the opportunity, feeling as we do that the article needs considerable clarification so that your large reading public may have a broader basis upon which to judge the current state of vehicle safety design.**

**Time did not permit us to attempt anything like a definitive answer to all possible questions raised in the article—which is probably just as well, considering your space limitations.**

**In any case, thanks again for your courtesy in allowing us "equal time." The gesture is appreciated.**

**Harry A. Williams**
**Managing Director**
**Automobile Manufacturers Association**

***Turn the page for Detroit's comments on safety: "Why We Do Make Cars Safe"***

***A statement by the Automobile Manufacturers Association***

# Why We Do Make Cars Safe

**BRUTAL TESTS** are the rule for new models and all individual components. This action photograph shows the movements of dummies in a snubber test creating deceleration forces of 10 Gs. The auto industry maintains 22,000 acres of proving grounds worth $100,000,000.

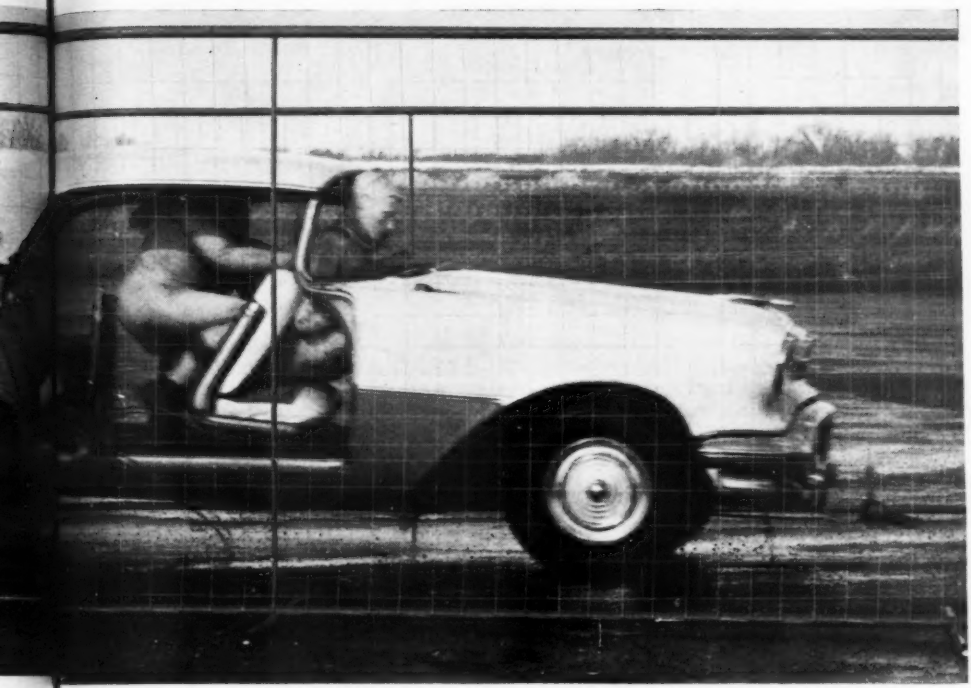
THE automobile industry has a deep and natural interest in highway safety. We deplore the tragic toll of traffic accidents and are anxious to contribute in every possible way to its reduction. We also have a realistic appreciation of the fact that our market depends directly on the appeal of our products, influenced to a marked degree by safety as well as by considerations of pleasure and utility.

This interest has prompted the industry to strive intensely and productively to enhance the inherent safety of automobiles and to encourage their safe operation and the provision of a safe environment for their use.

We are gratified to note the increasingly constructive interest of so many agencies—public officials, civic groups, public-information media, and others—in highway safety.

However, we are also deeply disturbed by the extent to which concern over this

**ROLLOVER AT PROVING GROUND** is standard practice, part of the rigorous crash testing that automobile manufacturers have conducted on each new model since the 1930s. Forward crash effects on passengers can be simulated by the use of "snubbing" equipment which stops the vehicle with the force of a collision, but without damage to the vehicle.



problem has provoked well-intentioned but misguided proposals which serve only to confuse the issue and retard productive action.

It is the considered opinion of the Automobile Manufacturers Association, acting as spokesman for the industry, that the article, "Why They Don't Make Cars Safe," published in the September, 1961, issue of POPULAR SCIENCE, represents just such a proposal because of the extent of its misinformation and unwarranted conclusions.

We therefore welcome the invitation of the editors of POPULAR SCIENCE to "answer back" to the criticism implicit in the title of this article, as a means of affording readers a more complete and factual basis on which to form their own judgments.

The article was based upon four fallacious assumptions:

a. The way to build vastly safer cars is well known.

b. Vehicle design improvement is the most promising means of achieving greater safety.

c. The automobile industry is deliberately failing to emphasize safety.

d. Federal regulation of vehicle design is the only answer.

To help provide some degree of perspective, let's examine several of the article's specific statements, one by one:

1 "For years designers have known what to do . . . These changes have been studied, developed—and ignored."

This unfounded charge itself ignores the unbroken chain of safety innovations and refinements originated in automobile-industry laboratories, developed and tested by industry engineers, and voluntarily applied to cars to make safe driving easier and provide greater protection against crash injuries. These include such prewar advances as four-wheel brakes, all-steel bodies, safety glass, Sealed Beam headlamps, and even more basic items such as the windshield and windshield wipers. Later advances include increased visibility through larger window areas, improved door locks and recessed steering-wheel hubs, plus continued improvement in simplifying controls and making

CONTINUED

them easier to operate.

**2** "The death toll continues to climb." This is fiction. The highest toll on record was 20 years ago, in 1941, when it reached 39,969. Through the 1950s the annual toll fluctuated between 34,763 and 39 628; it has not reached 39,000 since 1956. During these two decades the number of cars has doubled, miles driven have more than doubled, and the death rate per 100-million-vehicle miles has dropped steadily from 12.0 in 1941 to 5.3 in 1960. For the first six months of this year it is estimated at 4.8.

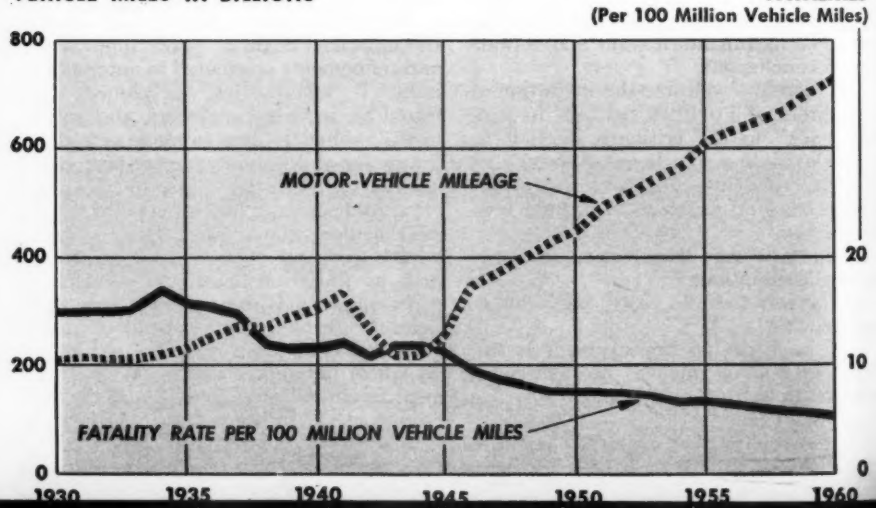
**3** "The remedy is obvious: federal laws either to permit the auto industry to police itself on safety standards or actually to prescribe those standards . . . The state agencies do not have the money, the people, or even the clear authority to specify improved auto designs."

The proposed remedy is neither obvious nor backed up by any factual data in the article. On the contrary, state legislatures and motor-vehicle administrators have long held and vigorously exercised the power to specify the performance required of a long list of safety items, including such things as brakes, headlamps, signaling equipment, and the like. Industry "self-policing" has given life to a long history of cooperative actions in the field of safety, among which the development, adoption, and repeated improvement of Sealed Beam headlamps is merely one example.

The virtue of competition in spurring all kinds of development is also completely overlooked. Basically, however, the most important consideration that is ignored is that safety is too much involved in all elements of automotive design to permit its effective, isolated control by a government agency. On the contrary, federal standards might very well put the brakes on continued progress by the in-

**CLEAR VISION** for the driver is a major objective of the modern automobile designer. Auto companies extensively test defogging equipment in each new model. In the test shown above, with five passengers in a closed car, the fogged windshield cleared in two minutes at minus 10 degrees outside temperature.

**DRIVING UP, DEATH RATE DOWN:** This chart shows how the nation's fatality rate has declined during the past three decades. While the number of vehicles in operation and the mileage traveled have doubled and nearly tripled in the postwar years, total fatalities have failed to top the peaks of the 1930s and 1940s, the National Safety Council's statistics show.



**GOOD BRAKING** is a vital requirement for a safe automobile. No other component of the car receives more careful attention from the safety standpoint. Steep grades at auto-company proving grounds, such as the one shown above, are used to test brake durability, heat dissipation, and fade characteristics.

**THIS SPECIAL DEVICE,** which is designed to test the safety qualities of an energy-absorbing steering-wheel design, is another example of simulating accident forces in tests of automobile components. The pendulum that strikes the wheel represents the exact weight and momentum of an average car driver.

dustry and would very likely involve the very "pet gimmicks" about which the author himself worries at the state level.

To say that federal control is better than state control begs the question—no valid case is made for the kind of control recommended by the author. Citing federal regulation of common carriers in interstate commerce as a precedent for regulating the safety design of private passenger cars makes no more sense than saying that the existence of the FBI warrants nationalizing all state and local police forces.

And alleging that the federal government "has the facilities to do the job right" is utterly at variance with the facts. The government no more has the laboratories, the automotive engineers, the multimillion-dollar proving grounds, and other resources needed for this job than it has to undertake any other complex technical function traditionally handled by private enterprise and local governments. Considerations like these led the Secretary of Commerce to report to the Congress in 1959: "The direct projection of federal authority into highway safety functions that have been the responsibility of state and local governments is concluded to be impractical, and would only serve to weaken state and local authority."

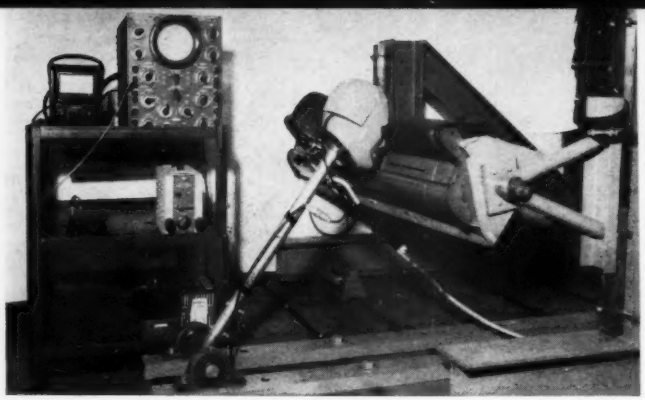
**4** "The '62 models will be equipped—at no extra cost—with anchorages for seat belts. 'Anchorages' means four extra holes in the floor."

The author was obviously ignorant of what a seat-belt anchorage is. Anchorages are specially engineered units welded to the floor pan, provision of which involves substantial cost and modification of vehicle production procedures. The industry is providing the anchorages because it will make it still easier to install and use seat belts—and it agrees that belts, properly installed and *used*, can make a real contribution to reducing the severity of accident injuries. Its steps to encourage popular demand for belts are covered in another section.

**5** "Modern cars . . . are not as safe as we know how to make them."

This statement is a left-handed way (abetted by the use of italics in the original article) of implying that the auto industry has deliberately withheld safety advances. It chooses to ignore the fact that safety is always a relative term and a factor that somehow has to be kept in reasonable balance with other product qualities that are important to the public. Quite seriously and without any attempt to be coy about a deadly serious problem, let us face up squarely to the fact that nothing is "as safe as we know how to make it"—from bathtubs to bomb shelters. However, the modern automobile has no characteristics that make it an inherently "unsafe" product.

CONTINUED



**INGENIOUS EQUIPMENT** for measuring accident effects in crash-injury studies has been contrived by automobile-company research staffs. The device shown at left is used for evaluating the relative energy-absorbing characteristics of instrument-panel structural shapes and cushioning materials. The machine simulates forces that might be applied by an auto passenger in a head-on collision.

**6** "'The only way to solve the traffic-safety problem,' concludes Dr. Daniel P. Moynihan of Syracuse University, 'is to establish a federal automotive agency that will develop and then prescribe safe designs for automobiles.'"

The report of the Secretary of Commerce mentioned earlier applies here, too. However, the National Safety Council may be presumed to have some stature in this field as well, and it has said: ". . . the strength of the safety movement lies in the voluntary participation . . . of all who are in a position to promote safety. . . . Specifically . . . the manufacture of safe products on a voluntary basis [is] preferable to legislation and government regulation."

**7** "Safety can be furthered by many different actions. . . . But the fastest way to get results is to redesign the car."

This unsupported claim would represent the easy way out for all but the automobile manufacturers—if the facts supported it. They do not. Progressive cities and states have established safety records which suggest that the fastest route to safety is better traffic engineering, enforcement, and education in more jurisdictions. The same kinds of cars are used everywhere, yet Connecticut continues to achieve a death rate more than 50 percent lower than at least half of the other states. How did Chicago reduce deaths 30 percent in a recent five-year period? How did Detroit cut average annual deaths by one-third in the 1941-60 period despite doubled traffic? By intelligent study of the local situation, firm administration—and keeping everlastingly at it.

**8** "If you could just keep car doors from flying open in crashes, you could save 5,500 lives every year. That's been known since 1958."

Substantial and repeated progress has been made in improving door locks since 1955. The Cornell Crash Injury Research Project, cited by the author as an authority, is heavily supported by the auto industry. Its latest figures do not yet fully reflect the gains because of the time lag in gathering and processing data, as well as because of the relatively slow increase in the percentage of these newer cars on the road. The gains are there, nevertheless; they are real, and will become steadily more visible.

**9** "Remaking the highway system—a favorite safety proposal—would take generations."

We do not have to rebuild the entire national highway system to make tremendous progress. Modernization of the most heavily traveled roads is already making a major annual contribution, and the Interstate Highway System of limited-access freeways is scheduled for completion in 1972. The latest study of its benefits alone indicates an annual saving of 9,000 lives. We think that's a worthwhile endeavor.

**10** "The 10 steps that will make cars safe . . ."

We insist that cars now have a high degree of inherent safety, but the auto industry is working—as it has always worked—to make them still safer. As to specific items listed:

*Seat belts.*—The belts in question were designed and developed by the industry. The key to their effectiveness is constant use, and it is generally agreed that public acceptance has not reached the point at which making belts standard equip-

*[Continued on page 224]*

Numbers are punched in coded plastic card.

Insert card, lift receiver; number is dialed.

## Punch cards will speed telephoning

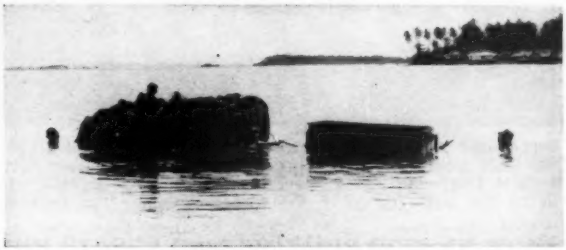
If you make a lot of repeated phone calls, you may be in the market for an automatic card dialer that Bell Telephone will have available late this year. You simply punch the numbers on coded plastic cards, insert one in a slot, lift the receiver, and press a start bar after you get the dial tone. A release bar frees the card when you have finished talking. Up to 40 cards can be stored in the back of the phone housing. Estimated cost will be $3 to $4 extra a month.

### Mechanical gopher

Powerful, truck-mounted rigs are boring postholes down the centers of roads for steel-mesh guard fences in the national highway-building program.

The self-powered machine exerts a pressure of 16,000 pounds, handles bits up to 2 feet in diameter and 6 feet long, and can dig nearly 60 holes an hour even in heavily compacted rock. The operator stands on an outboard platform and pulls control levers.

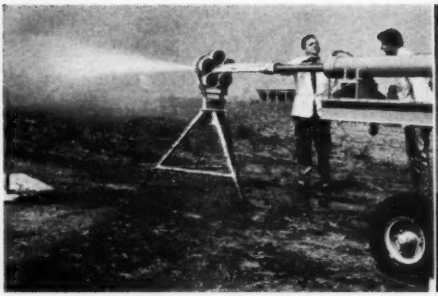
Land-Rover is wrapped securely in a tarpaulin . . .



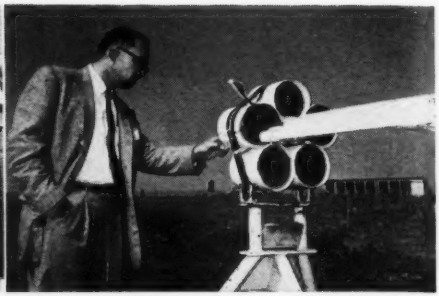
. . . and floated across stream, pulling trailer behind.

### British army's Land-Rover also swims

British troops in Singapore float their Land-Rover across unbridged jungle rivers by wrapping it in canvas. The scout car is driven onto a tarpaulin, which is folded over the body and lashed down. The car is then floated with its watertight trailer attached, and the six-man patrol pushes and swims it to the other side.



Needle point of liquid from nozzle . . .

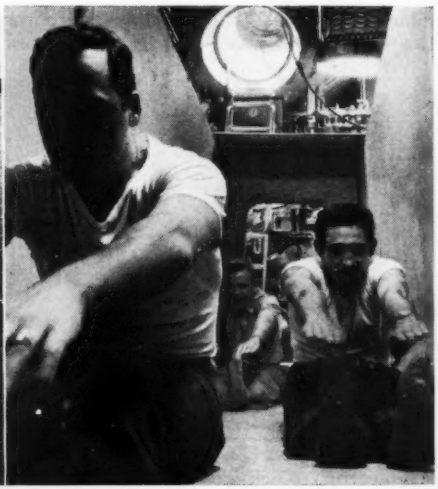


. . . cuts simulated rocket propellant.

## Liquid lathe shapes and cuts

A lathe that looks and fires like a cannon has been developed by North American Aviation. It delivers a needle point of liquid under high pressure to cut through highly explosive solid propellants and permit safe removal from rocket-engine casings. In a demonstration at the company's plant in El Segundo, Calif., it cut through cement, wood, and tough plastic. The machine resulted from research into the shaping of exotic materials for spacecraft.

**INFLATABLE GYMNASIUM** is tried out here on the dock beside the USS Theodore Roosevelt. It is 4 feet wide and 22 feet long, and will fit in the passageway of the torpedo room.



**SETTING-UP EXERCISES** on the bouncy floor help sailors keep in condition, and the air walls prevent skinning of elbows or other injury on the solid steel of the submarine's structure.

## Blow-up gym built for men aboard nuclear sub

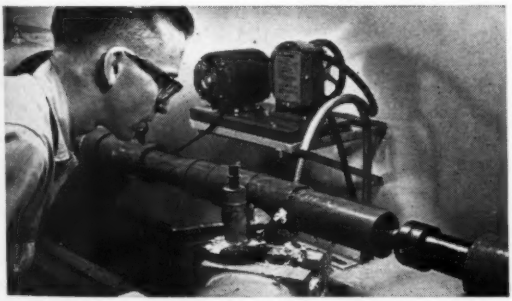
Not a new weapon for the Navy, but a device to keep underwater crews fit is this inflatable gymnasium built for the Polaris-armed nuclear submarine Theodore Roosevelt. It's designed for the only available space: the passageway in the torpedo room. Three men can install it in 30 minutes, and it can be deflated and stored when not in use. Goodyear built it—to the specifications of Commander William E. Sims—of the same material used for inflatable bunks and gangplanks [PS May '61]. When in use, the gym will be equipped with a punching bag, rowing machine, weights, and similar athletic gear to keep the crew fit.

**NEW APPROACH LIGHTS** are set in two rows of six lights each—three on each side of the runway. Each light has white and red beams. If both rows show white, it means the pilot is too high; both red, too low. Front row white and back row red means he is on the "beam."

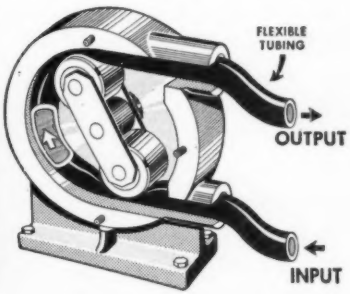
## Glide-path lights guide planes in

Even in clear weather, plane crashes have been caused by landing too short or overshooting a runway. To avoid approach errors, the Federal Aviation Agency has adopted a visual system of white-red split-beam lights. These are set in metal boxes at each side of a runway. Color coding tells a pilot if he is coming down on a safe glide slope. The lights, visible up to 5 miles by day and 15 miles at night, give warning for a go-around before a plane is committed to a final approach.

**FIRST INSTALLATION,** at New York's LaGuardia Airport, is under test by FAA, which will install air "traffic lights" at 37 other fields. Developed by Britain's Royal Aircraft Establishment, they are made here by Sylvania.



Pump safely recirculates abrasive coolants.




Squeegee action of two rollers produces flow.

### Pump that never gets wet

A flexible tube passing through this pump keeps the liquid it handles from coming in contact with its working parts. The one shown here is used to carry coolant to a cutting tool as a laminated epoxy-fiber-glass piece is turned in a lathe. As the coolant flows over work and tool, it picks up powdered glass and plastic. This abrasive liquid is caught in a tank from which the pump recirculates it. Squeegee action of the revolving rollers keeps the fluid moving. The pump is built by the Randolph Co., Houston, Tex., for corrosive and abrasive liquids.

*Cross-Channel power swap:*

# Alpine Snow Will Boil English Eggs

**By David Scott**

ELECTRIC power—160 million watts of it—will start shuttling back and forth under the English Channel in December. France will export power to England and England will export power to France. Each is expected to buy as much power as it sells and yet both will make money on the deal.

This Alice-in-Wonderland international trade is not the only curious part of the scheme:

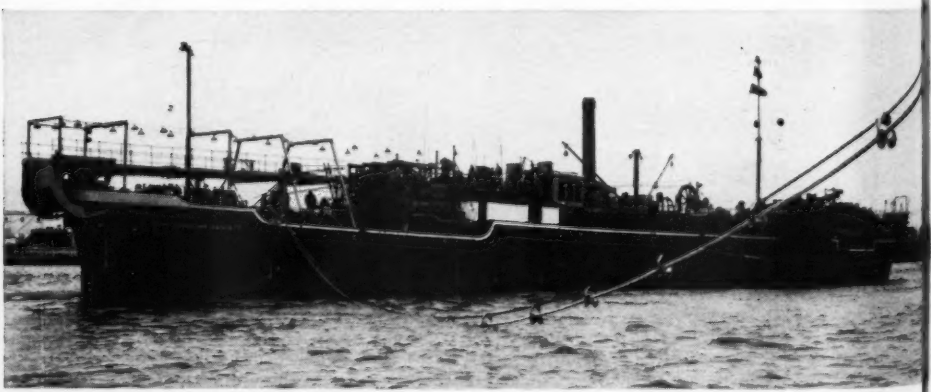
- The power networks of both countries distribute 50-cycle alternating current. The two networks have recently been tied together by submarine cables. But these cables will be carrying *direct* current.
- Steps had to be taken to avoid sending ships in the Channel off course.

**STRIPPED LENGTH OF CABLE** for power line shows its complex construction. Core (top) is of copper. Covering it are multiple layers of steel, paper, rubber, cotton, lead. Bottom section shows double insulation shield of cotton tape and jute yarn.

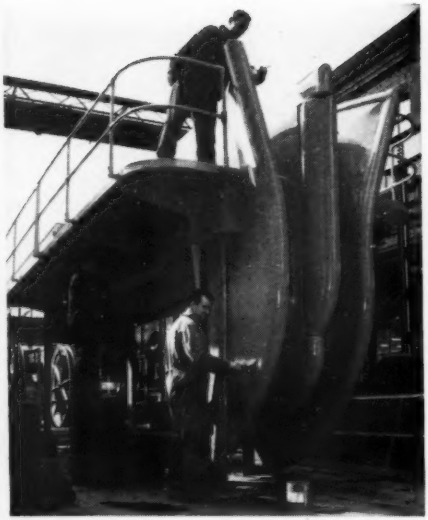
- The same devices will change the AC to DC and back to AC—entirely electronically.

The project will save each country about $700,000 a year at a cost—$12½ million—about half as much as the additional power plants each would have to build to do the same job.

***Power for subways.*** One big reason why this scheme has intrigued engineers for 40 years is the difference in time be-



**SUBMARINE CABLE,** supported by rollers to prevent damage by dragging on river bed, was loaded aboard ship at anchor in the Thames. The vessel carried 16 miles of twin cable.



**SPECIAL STERN SKIDS** for cable-laying are shown above being painted before installation on ship. The self-adjusting central fin kept the cables a yard apart on the sea bottom.

**TWIN CABLES** were payed out over the stern. Guide skid, offset to port side, kept them clear of ship's propeller and rudder. Hand brakes equalized speed as the cables were laid.

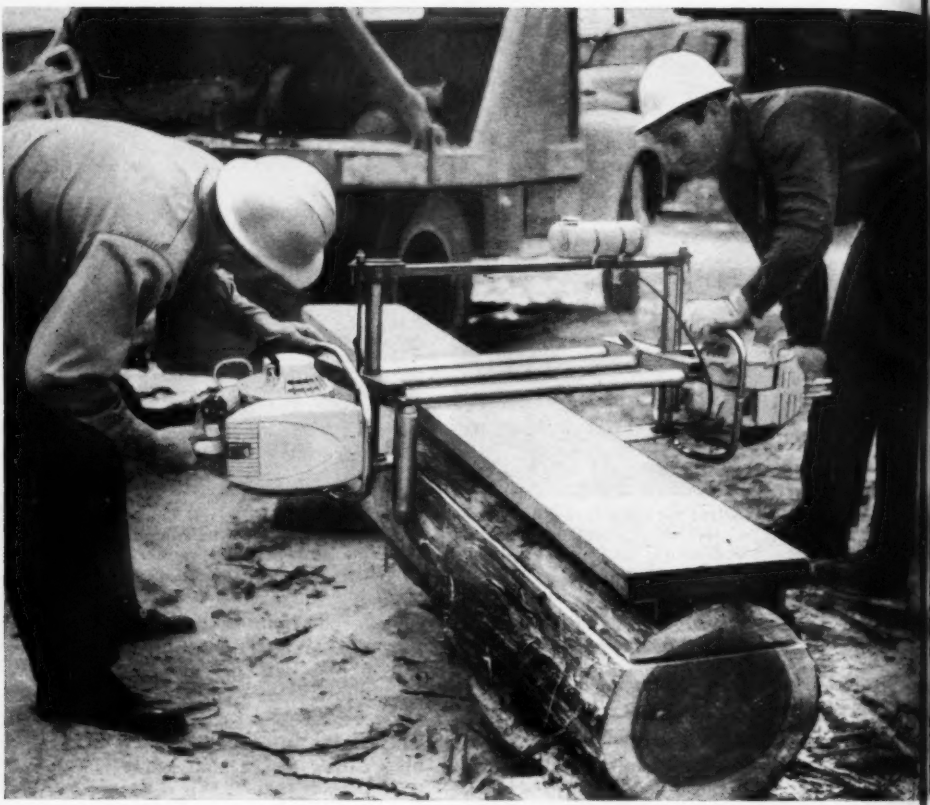
tween the two countries. French clocks are an hour ahead. This tends to create an around-the-clock pattern that dovetails peak demands for electric power. The British, starting to work later than the French, have surplus electricity that can speed the Paris subway during its morning rush hour—and the French will have power to spare by the time the London Underground, with homeward-bound straphangers, needs a boost.

Seasonal help each country can give the other is just as important. France fills about half her needs with cheap hydroelectric power; England depends almost entirely on coal-fired plants. British homes can be lit by water from melting Alpine snows that would otherwise spill over the dams. In dry seasons, the French can draw on the British plants with their ready supply of coal.

*[Continued on page 218]*

**COMPLETE CABLE CARGO** for one voyage is shown coiled up at riverside factory from which it was loaded onto Channel-crossing ship. Weight of one submarine-cable load was 1,200 tons.

**MIDGET SUBMARINE,** shown (right) aboard a fishing vessel, was used by French frogmen to check and photograph the cable-laying operation. Frogmen straddle it like a bronco.



1. **FIRST CUT** is made with a pilot plank spiked to the log and held level by two lengths of angle iron nailed to underside at the edges.

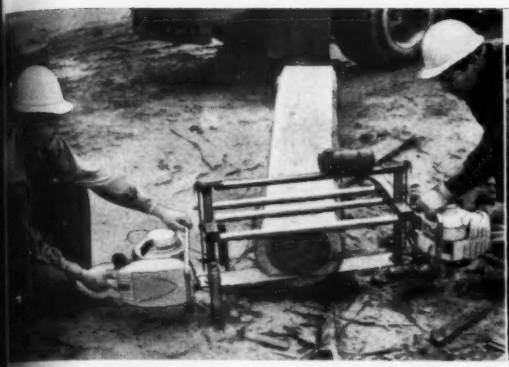
## Logs into boards with a chain saw

With a set of rollers, called an Alaskan mill, you can use a chain saw to cut logs into boards right on the site where the tree was felled. The mill—three rollers in a frame that bolts to the saw bar—is adjustable for thicknesses from ½ to 18 inches, widths to 4 feet, and lengths as long as the log. Allowance is made for the kerf.

A pilot plank spiked to the log guides

## Channel car transport

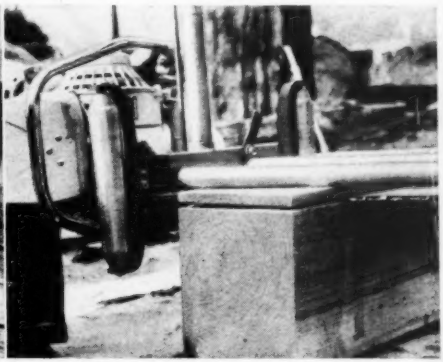
With a new front section adding 12 feet to its length, the DC-4 at left now flies automobiles as well as passengers across the English Channel. Renamed the ATL-98, the remodeled plane can carry five medium-size cars in its nose under a raised flight deck. It flies at 200 m.p.h. from Southend, England, to such interior Continental cities as Lyons, Strasbourg, Dusseldorf, Bremen, Basel, and Geneva.



**2. BOTTOM SLAB** is next taken off with saw dropped in mill frame. Log is propped above ground surface to clear underpart of carriage.

**3. TURNED ON EDGE,** log is again fitted with pilot plank. Plank is trued to sides with a carpenter's square, then spiked to log.

**4. THIRD SLAB** is sawed off with mill frame guided by rollers running over pilot plank. Three sides of the log are now square.



**5. BOARDS ARE FINALLY CUT** to thickness with saw set at required distance in frame. Squared top surface now acts as level guide for rollers.

the saw evenly in taking off the first barked slices. The rollers then run along the sawed surface, making the following cuts parallel. Boards can be stacked on edge and clamped for cutting into square-dimensioned lumber with the same saw.

Alaskan mills are available in six sizes to fit any make chain saw of six hp. or larger. They are made by Nygran Industries, Ltd., of Richmond, Calif.

## Pool shaped like Texas

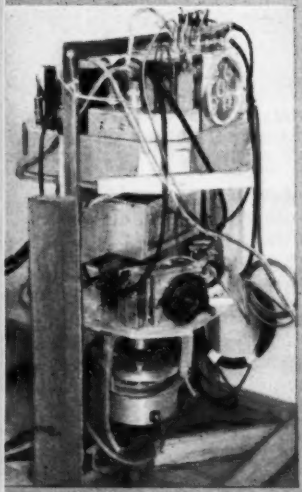
Here's a swimming pool that would only be built by a Texan in Texas. It's at Plano, just north of Dallas. It measures 100 feet from Texarkana to El Paso, 93 from the tip of the Panhandle to Brownsville. Diving boards are in the Panhandle, swimming in Central and East Texas, wading in West Texas and the Rio Grande Valley. There are cabanas in Mexico and dressing rooms and showers in the Gulf.

**To watch hurricanes making up over the sea, the Navy builds—**

# A Robot with Sea Legs



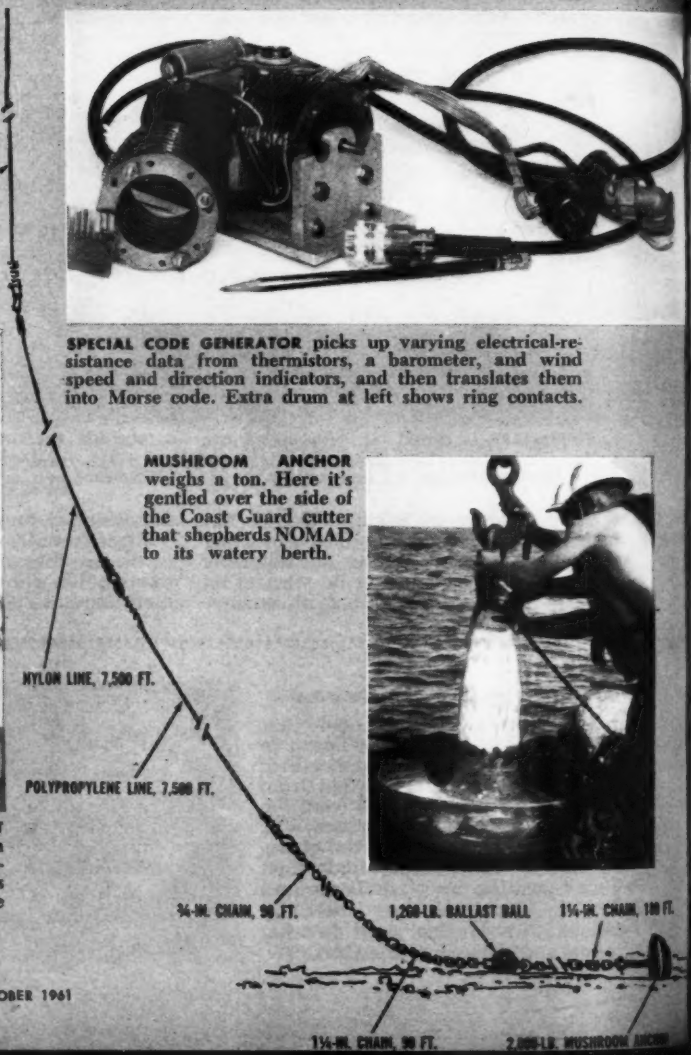
**SPECIAL CODE GENERATOR** picks up varying electrical-resistance data from thermistors, a barometer, and wind speed and direction indicators, and then translates them into Morse code. Extra drum at left shows ring contacts.

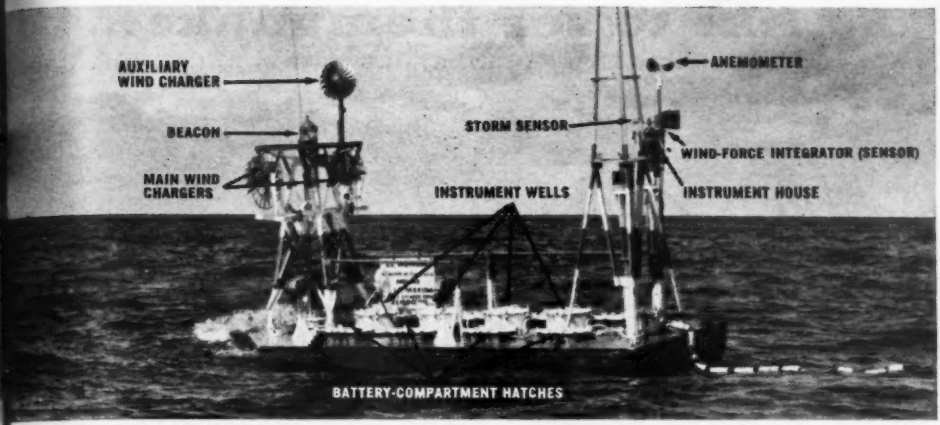


**EQUIPMENT MOUNT** (one of four) is shown with aluminum shell removed. Barometer is at bottom; above it are parts of timing gear.

**MUSHROOM ANCHOR** weighs a ton. Here it's gentled over the side of the Coast Guard cutter that shepherds NOMAD to its watery berth.








**On station, NOMAD (Navy Oceanographic Meteorological Automatic Device) eyes weather.**

HURRICANES grow over water. Why not keep a weather eye on them from the sea itself? The Navy, Commerce Department, and Bureau of Standards have done just that with NOMAD, an unmanned weather sensor that all but smells a storm while it's brewing. As proof, weather men point to 1960. On September 12 the station warned the Gulf Coast of Hurricane Ethel 48 hours before the storm broke.

NOMAD's chief charm is not its looks (picture a ship that got too close to a buzz saw fore and aft) but its lack of human failings. It can sit untended in deep ocean—never seasick, never lonely—faithfully transmitting weather clues at intervals, stepping up the timing when feedback gear starts twitching.

***Like waterless cookers.*** Sunk into its hull are four airtight wells that house weather-sensing and transmission gear. Rising from the 10-by-20-foot aluminum deck on pint-size masts are storm sensors, an anemometer (especially rugged to measure hurricane winds), a wind vane, and other weather pulse takers.

Also on deck are a pair of wind chargers—little windmills—for juicing up the storage batteries. And this year, a silicon solar battery will experimentally tap solar radiation just under the ocean surface. It may be the forerunner of power-pumping equipment—experts hope—to replace the windmills.

Normally NOMAD reports every six hours in five-minute spurts. Its short-wave talks are partly given in variable pulse tones (for wind direction, solar radiation, and the like) and partly in international Morse code.

***In a blow.*** If the winds pick up and stay above 33 knots, a new storm sensor added this year will get the NOMAD hustling in a report every hour. Already in operation is a sensor that works at the nudge of 22-knot winds. While it doesn't change NOMAD's rate of transmission, it does count how many minutes winds have exceeded 22 knots since the previous regular transmission. Thus, it clocks short-duration squalls—particular hazards of light shipping and aircraft.

NOMAD has been strengthened this year to take really rough weather. (Riding out Ethel last fall she partially parted her mooring and turned broadside. But even with some gear under water, she she still beeped in accurate reports.)

The newly strengthened mooring system consists of heavy iron chain with a ballast ball, nylon and polypropylene cables—15,000 feet of them to give 'er plenty of scope in a blow—and a 2,000-pound mushroom anchor.

Seasoned with several salt-water baptisms, NOMAD is now ready for production. Plans call for seven sisters to be berthed in both Atlantic and Pacific waters. Their moderate cost (about $50,000 each) and good life expectancy (at least 10 years) will make them one of the best investments the Government has ever made.—*Joan Steen.*

# "I'd like to see them make..."

**A FRUIT-PICKER'S BAG** or basket with a sleeve-like extension. Just drop the apples or other fruit down into the chute clipped to your arm. —*Louis Burzdak, Los Angeles.*

**TAMPERPROOF GAS TANKS** with a screen guard in the inlet pipe, set low enough to insert the fuel hose, but too high for a thief to siphon off gas.—*Tom Whipps, Columbus, Ohio.*

**PISTOL-GRIP HANDLES** on the burners of propane torches. A trigger valve would control the flame. Then long jobs would be easier on your hand.—*Andrew Vena, Philadelphia.*

**MATTRESS FLIPPERS** built into beds. Few women wrestling with a mattress for a double bed succeed in turning it over without calling for help.—*H. J. Graw, Brooklyn, N.Y.*

**BUILT-IN STORAGE** in automatic washers to house soap box and bleach bottle. There must be some extra space under that glossy housing.—*Elena Echavarria, Medellin, Colombia.*

Everyone has his own pet idea of a gadget that he would like to see in general use. What's *yours?* We will pay $5 for each one published. Please use Government postcards only. Send to ILTS Editor, Popular Science, 355 Lexington Ave., NYC 17. Write your name and address clearly. Contributions cannot be acknowledged or returned.

**Stretcher climbs cliff**

To rescue injured seamen from the beach below Beachy Head's white cliffs near Eastbourne, England, Constable Harry Ward of the beach patrol put a stretcher on sled runners. It's pulled up the rugged cliff face by a winch operated by two men at the top.

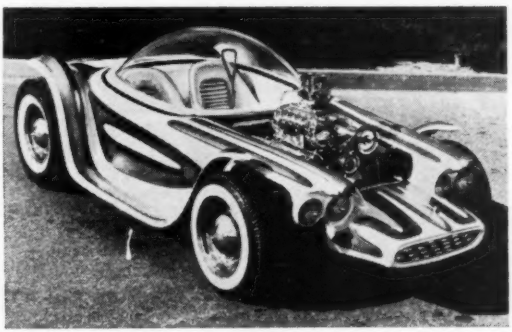
**Aircraft for earthmen**

Airman 1C John R. Collins of Tinker Air Force Base, Oklahoma City, combined his interest in planes and cars when he bought a 1941 Chevrolet sedan for $25. He added four aircraft bucket seats and a 255-hp. bus engine. Then he installed 33 instruments and other gadgets above his head, at his side, and on the dash—among them a manifold-pressure gauge, fuel-air ratio indicator, fuel- and oil-pressure gauges, and oil and carburetor-air thermometers. He left the outside of the car alone: It just looks like a 1941 Chevy.

**Rub-a-dub, one-man tub**

An ordinary bathtub fitted with an outboard motor makes an interesting boat on Piddinghoe Lake in Newhaven, England.

Alan Witt, a Brighton student, rigged up the craft as a stunt for charity. Under its bottom is a deep keel to keep it upright.



**Out-of-this-world hot rod**

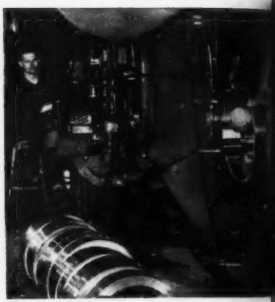
This homemade dream car is driven by a joy stick that steers, accelerates, and brakes. It consists of a 1950 Oldsmobile chassis shortened three feet, fiber-glass body, and a chromed, supercharged Olds engine that runs on methanol and nitromethane. Owner-builder Ed Roth is a bearded hot-rodder and artist from Maywood, Calif., who paints grotesqueries on sweat shirts.

# The Story of the GIs' Old Flame

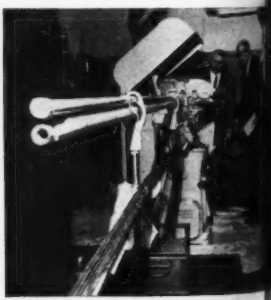
***World War II gave the Zippo lighter its start, when servicemen all over the world spread the word: "It works!"***

**By Jim McMichael**

***Some of the operation***



**ZIPPOS BEGIN** with tops and bottoms. Here case bottoms are being stamped out of long rolls of sheet brass by a hydraulic press. Annealing and welding will be the next steps.

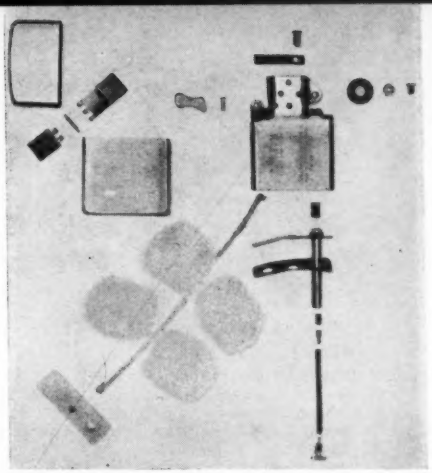


**BRASS RODS** projecting at front left are fed into an automatic screw-making machine. At the other end, the flint-tube screws pop out completely finished.

INSANE as it seems, there is one American firm that guarantees its product *forever*. You can probably guess it. It's Zippo, "The lighter that always works." If it doesn't, the company blithely adds, "We fix it free of charge —forever."

They sound pretty sure of themselves. But with good reason: Not only has the company survived its birth pangs during the depressed Thirties, but it's seen sales grow every year since.

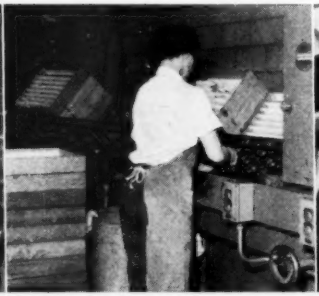
The Zippo story begins in 1932. It's the story of one man and one chance occurrence: George G. Blaisdell noticed a friend of his using a cheap Austrian lighter, as clumsy as it was unattractive. The top had to be removed for it to function, and it was a two-handed operation.



**SKELETON OF A LIGHTER:** All Zippos contain 23 parts, shown laid out above. One part, the sparking (flint) wheel, cost the company about $300,000 to develop. The process is secret.

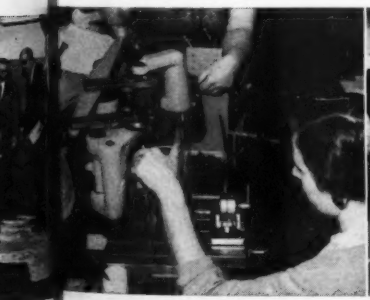
***in making Zippos are shown below***

**A GAS-TIGHT FIT** is a must for fuel assembly. Electronic soldering equipment does the job. Degreasing, application of flux, and soldering itself are automatically controlled.



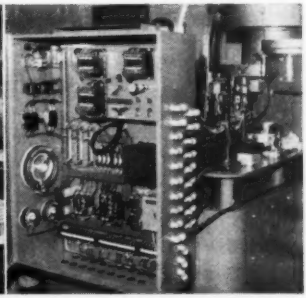
**LIGHTERS ARE DUNKED** into 36 plating tanks over a distance of 200 feet. The plating operation starts with cleaning, acid-dipping, electro-cleaning, goes on to plating, oiling, drying.

**NOT A CLOTHES HANGER,** this is a plastic-coated rack that holds 60 cases as they swim through the plating stages. The plastic doesn't scratch the brass lighter cases and is acidproof.



**WANT YOUR SIGNATURE** on a lighter? For a dollar extra the girl will run an electronic pantograph over a personalized Zippo, reproducing your name with a forger's accuracy.

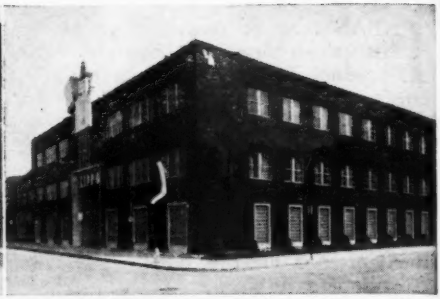
**LAST STAGES** of Zippo assembly add the innards: flint wheel, cam and cam spring, flints and flint-spring unit, wick, cotton balls, and finally felt bottom pad you douse with fluid.



**MECHANICAL ROBOT** checks lighter flints for uniformity. It then makes a count and sends flawless units on for packaging in the familiar plastic Zippo dispenser—all automatically.

CONTINUED

**LOOK CAREFULLY** and you can just make out the Zippo sign in its early, second-story loft days. Born in the depression, Zippo's production began to zoom in the days of World War II.



**ZIPPO'S HOME TODAY** is this modern million-dollar building at the head of Main Street in Bradford, Pa. More than 500 employees take home a yearly pay of $2 million.

Blaisdell said, "Why do you fool around with an ugly contraption like that?"

His pal answered simply, "Because it works."

Blaisdell reflected on that statement. Why not design a better lighter than that Austrian one? With a knowledge of machinery and metals he got from working in his father's machine shop, and a borrowed $800, Blaisdell started making lighters in January, 1933.

His first plant was in an unplastered second-floor loft over a service station. His "equipment" was a kitchen hotplate for soldering, a second-hand welding unit, and a punch press. The first month's production totaled 82 lighters. (They were called Zippos even then. Blaisdell had always been fond of the word "zipper.")

**ZIPPO'S CREATOR** is George G. Blaisdell. His inspiration came from an ugly Austrian lighter that *worked.*

In February, 367 Zippos came off the line and Blaisdell was ready to expand. He took over the rest of the second floor —tripling his rent to $30 a month. His first big boost came when the Kendall Refining Company placed an order for 500 Zippos.

Blaisdell realized that if he wanted to make the big time he couldn't "hide his light under a bushel." He saw to it that Zippos were used as punchboard prizes. He got rid of 300,000 that way. Others he gave away—to long-haul bus drivers, so that their passengers would get the message en route, across the United States.

***The big boom.*** When World War II came along, Zippo's business zoomed. The Army Quartermaster Corps started ordering Zippos in 500,000 and 1,000,000-unit lots. Servicemen all over the world spread the doctrine, "It works!" They bought Zippos by the carload in the PXs. Ernie Pyle praised the Zippo in his column many times. So did others. Blaisdell has framed fan letters on the wall of his Bradford, Pa., office from Pyle, Eisenhower, the Duke of Windsor, and George VI.

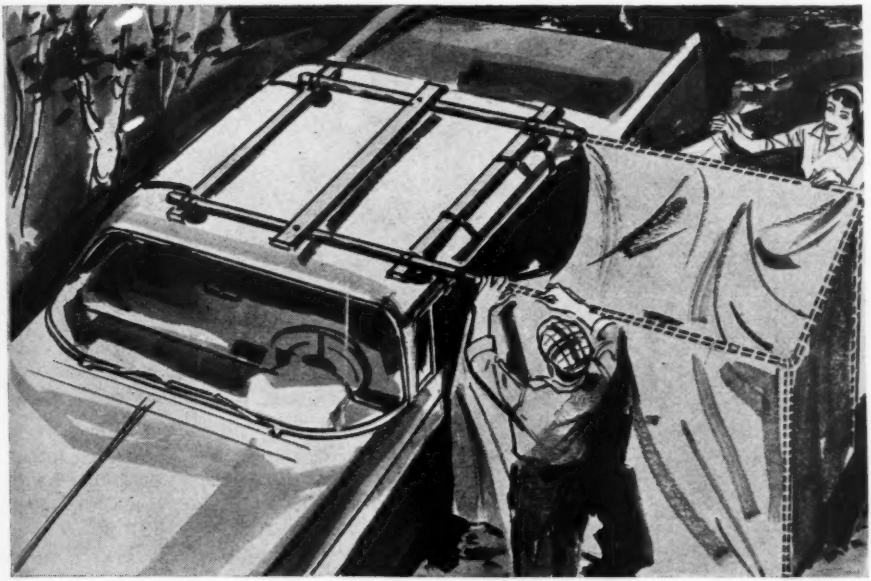
One letter, from David D. Michaels, reads, "My admiration for Zippo stems from the war days when all the pilots flying the hump from India to China considered the Zippo a lifesaving necessity. Everyone carried a spare Zippo, always primed with fluid, tucked into his parachute pack. Its purpose was to light a signal fire if the pilot were forced down in the wet jungle."

Blaisdell keeps a museum of Zippos of special interest. Some are battered specimens sent in by GIs who claim the lighters stopped bullets. Others had fallen into hay balers, or been run over by German tanks. One was even smashed in a 6,000-ton hydraulic press. All were replaced under Zippo's sweeping guarantee.

***Behind locked doors.*** If you're curious

*[Continued on page 214]*

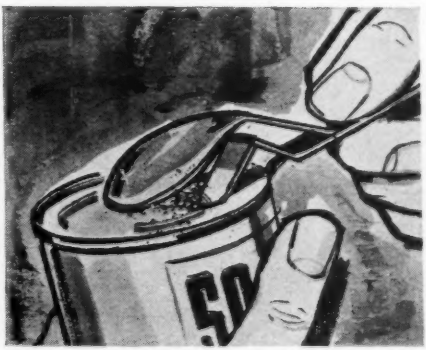
# New Ideas from the Inventors



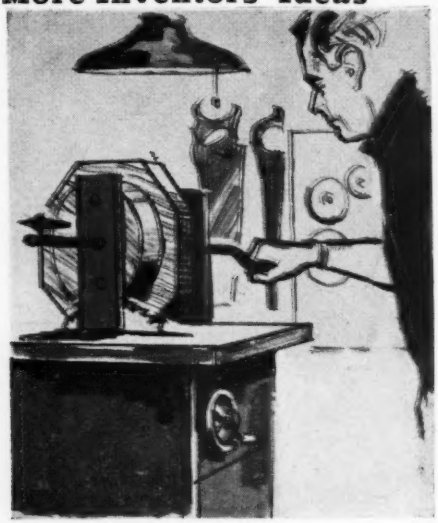
**Car-Top Rack Doubles as Tent.** You could pitch—or pack—a tent faster if your car formed one wall and supported the others. Telescoping cross rails, connected by a tie bar, would pull out of this recently patented frame. You'd prop two adjustable rods under the rail ends and cover the framework with a canvas.

**Magnets Stop Straying Carts.** A magnetic strip around the rim of a store's parking lot might keep shopping carts from leaving home. Magnetically triggered latches in the cart's wheel hubs would jam any wheel that passed over the strip. It could be freed only by a key.

**Can Opener Catches Spurts.** You could protect your clothing—and possibly the wallpaper—from the stains of beer or soda with this spray-stopping guard. A spoon-shaped shield would be welded or riveted over the point of a conventional metal-piercing can opener.



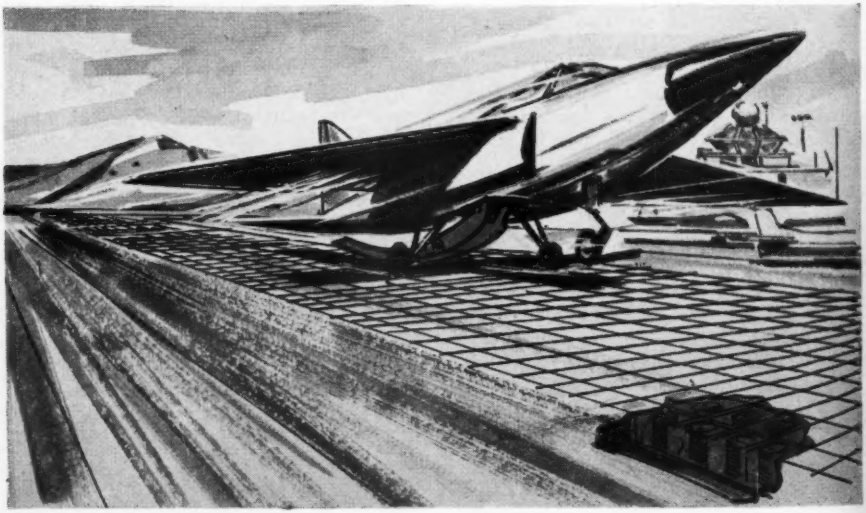
CONTINUED



**Saw Attachment Cuts Disks.** You could cut a disk on a table saw by drilling a block and clamping it to the partially threaded shaft of this attachment. You'd then place the shaft between uprights, adjust blade height, and turn a crank to feed the stock across the blade.

**Timer Shows "Old" Light.** You'd know whether to wait, amble, or dash across a street if the light were synchronized with a walk timer. This inventor suggests an illuminated arrow that ticks off the seconds to show a pedestrian reaching a crossing how much time is left.

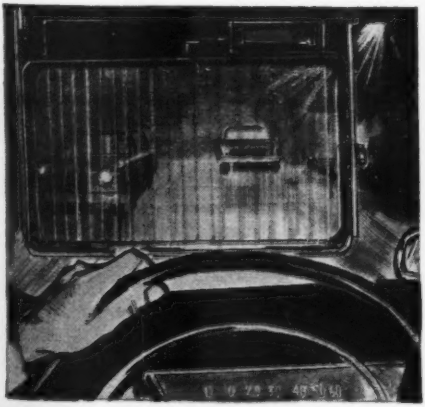
**Magnetic Ski Brakes Plane.** A grid of electromagnets under the paving of a runway might prevent overshooting accidents and let bigger planes use smaller fields. Magnetic force could be varied from the control tower; it would provide braking power, as needed, by acting on a metal runner in the plane's landing gear.



**Machine Types What it Hears.** Business notes and memos might be recorded more conveniently on a machine that printed out spoken words. A speech analyzer in this RCA invention would convert syllables into electric-typewriter signals. Spelling, however, would be phonetic.

**Shield Cuts Headlight Glare.** Two sets of movable, vertical prisms might give a driver control over headlight glare. Set in a straight line, the slide-mounted plastic prisms would be completely transparent. But shifted by a driver-operated switch, the surfaces would reduce light coming from the left. Right-side street lights wouldn't be blocked.

**Mechanical Checkroom.** You wouldn't end up with the wrong garment where there was a checkroom like this. You'd place your coat on a vacant hanger and get a metal check. To claim it, you'd insert the check in a slot, and a conveyor would move your hanger to the window.



*The following patents have been issued on these inventions:* **Tent**—*No. 2,870,774 to D. M. Blosser, Long Beach, Calif.;* **Cart lock**—*No. 2,964,140 to M. Berezny, Huntington Park, Calif.;* **Spurt shield**—*No. 2,867,900 to Chas. Hanington, Freeport, N. Y.;* **Disk attachment**—*No. 2,847,044 to W. Anderson, Pittsburgh;* **Walk timer**—*D 184,435 to N. Hastings, Huron, S. Dak.;* **Plane brake**—*No. 2,984,438 to F. Arnold, Amityville, N. Y.;* **Speech writer**—*Nos. 2,971,057-058 to H. Olson, Princeton, and H. Belar, Palmyra, N. J.;* **Glare shield**—*No. 2,976,759 to K. Bleuer, Roselle, Ill.;* **Checker**—*No. 2,967,081 to J. L. Kleinpenning, Eindhoven, Netherlands.*

*Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D. C., at 25 cents each. Design (D) patents are 10 cents. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.*

Three-passenger car needs only . . .

. . . a 50-cent piece for disassembling. It . . .

## Collapsible runabout for outdoorsmen

In five minutes, the three-wheeled Diehlmobile can be assembled or collapsed. Components are held together by self-locking screws and quarter-turn aircraft fasteners. The three-hp. engine has four forward speeds, providing good

### Sand thrower fights forest fires

A whirling rotor combats forest fires in Michigan by throwing sand on them. It digs its own sand and throws it in the same motion as far as 100 feet and up to 25 feet in the air. A 36-inch rotor is spun at 670 r.p.m. by a 132-hp. gas engine. Vanes at the periphery dig and toss 2 to 2½ cubic yards a minute.

The rotor turns in either direction to throw sand to the side, and can be angled forward or backward 45 degrees. Tossed sand is guided by a deflector that can be raised for fires high in trees or lowered to cover ground blazes. The Sandcaster is pulled by a tractor, but the Michigan State Conservation Department and U.S. Forest Service, which built it jointly, are designing a self-propelled one.

### Old dog learns a new trick

A kosher butcher in Brooklyn, N. Y., has retooled part of his plant to turn out circular frankfurters, the first change in design of weenies since their import from Germany 57 years ago. He bends them on a mandrel, joins the skin at the open ends.

The new hot dogs, says the innovator, are fine for eating in hamburger rolls.

. . . fits easily into a car trunk or . . .

. . . can be carried in a small cruiser.

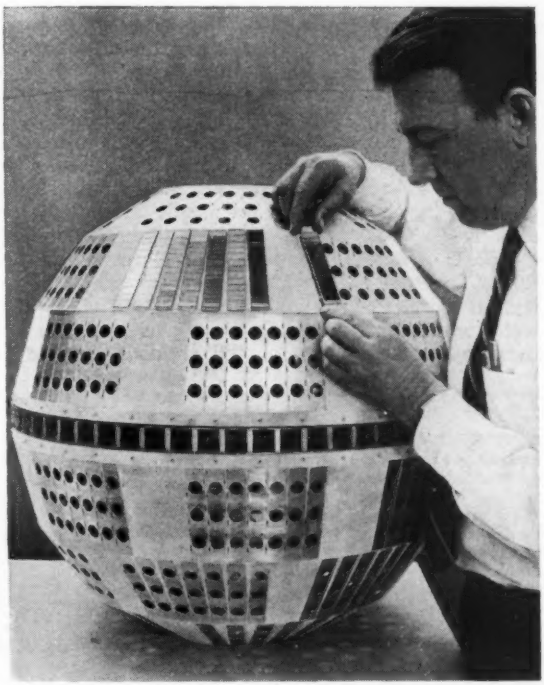
hill climbing as well as an 18-m.p.h. top speed on level ground. There's a reverse gear, too. A tiller steers the front wheel. The tubular-framed seat, of nylon impregnated with vinyl, doubles as a garden or boat chair. H. L. Diehl Co., South Willington, Conn., sells the standard model for about $300. Surrey top, heavy-duty tires, and underseat baggage case are extra-cost optionals.

## New satellite studded with gems

More than 4,000 sapphires, in platinum settings, will adorn a 27-inch globe being prepared for launching into space. Designed by Bell Laboratories, the bejeweled sphere is to be put in orbit as a radio relay station, to aid in developing a satellite communications system for transatlantic TV and phone calls.

Each of the satellite's oblong plates of synthetic sapphire covers a solar cell that turns sunlight into electric power. Because of its hardness, the man-made gemstones will resist erosion by meteoric particles, and protect a cell from damage during the satellite's expected life of 10 years or more.

The sapphires are brazed to platinum strips, which are soldered to a ceramic base—a combination chosen for almost equal expansion with heat. Assembled over solar cells, they are then attached to the satellite shell.



***Robot rigs stretch metal like taffy to make—***

# The 90 Miles of Wire in Your Home

**By Henry B. Comstock**

STRUNG, bent, coiled and crisscrossed, there's enough wire in the average six-room house to reach from New York City to Philadelphia. The reasons add up.

It takes a quarter of a mile to make your doorbell chimes go "bing-bong." There's over half a mile in the box springs and mattress coils of a twin-bed set, and a mile in a 36-by-80-inch screen door. Statistically, you own 37 small electric motors. Their collective field and armature windings total 35 miles. Even a yard of lamp cord contains 240 feet of strands, hair-thin to make it flexible.

To meet demands for wires like these, a single machine in a modern mill may whip out 10,000 feet of wire a minute. Watching the shiny stuff streak from the rig, it's easy to forget that the basic routine hasn't changed since the 14th century.

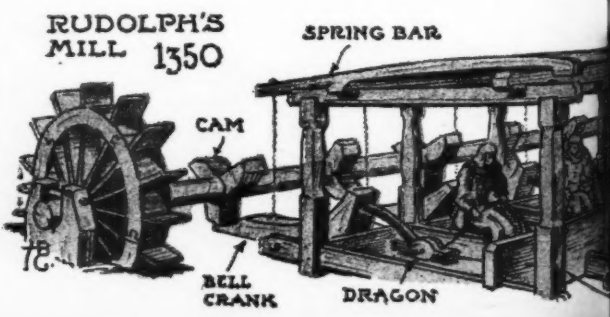
It was then that an unknown German genius discovered the trick of pointing a metal rod and yanking it through progressively smaller holes in a hardwood block, with tongs. Until then, all wire had been formed by spiraling and hammering thin sheets. With the drawing method, anyone could make it better and faster.

***Thank Rudolph.*** Soon another German added a fillip that turned the craft into today's major industry. Rudolph of Nuremburg loaded the shaft of a water wheel with cams. As the big oak axle turned, the cams rocked a line of bell cranks. Attached to

***Tough dies in tandem***

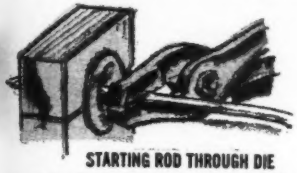
**1. MODERN WIRE-DRAWING RIG** has a series of progressively smaller dies to reduce copper rod to wire.

**TWELVE-TON** breakdown machine (above) turns out a mile of heavy wire each minute. It holds four coils of copper rod, welded end to end. Zigzagged through 13 ever-smaller dies, the rod is reduced at the finish line to 18-gauge wire.



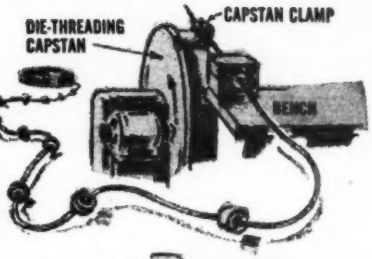

**FOURTEENTH-CENTURY WIRE** was made by the same drawing process used today. Curiously, Rudolph's mechanized mill of 1350 was far ahead of England's most productive 16th-century shop. In the latter, operators sat in slings, snatching at the metal with crank-connected tongs. Hard pressed for wire during the American Revolution, colonists resorted to still more primitive machines. These can be seen at far right.

## speed modern wire drawing

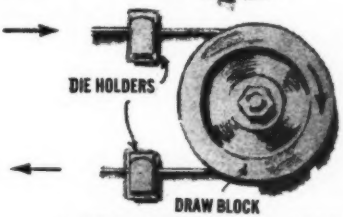


STARTING ROD THROUGH DIE

**2. END OF ROD** is point-shaped. This is forced into the largest die with a pair of pliers.



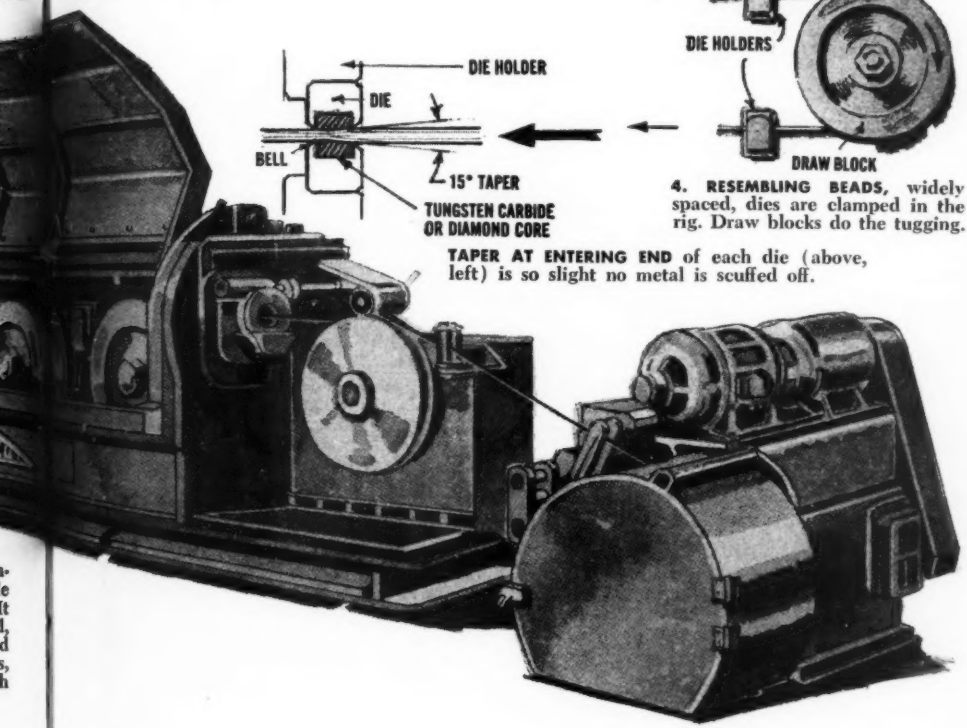

**3. POWER CAPSTAN,** at right, draws about 20 feet of rod through first die. Smaller dies then take over.

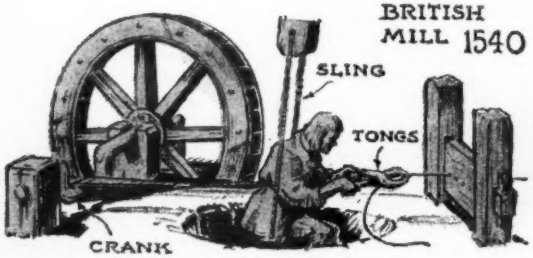


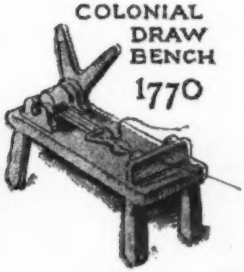

**4. RESEMBLING BEADS,** widely spaced, dies are clamped in the rig. Draw blocks do the tugging.




**TAPER AT ENTERING END** of each die (above, left) is so slight no metal is scuffed off.

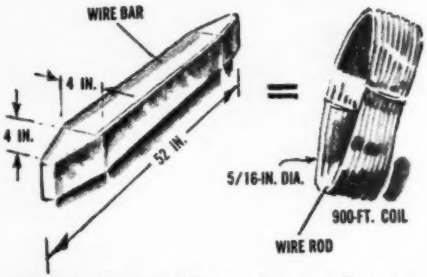




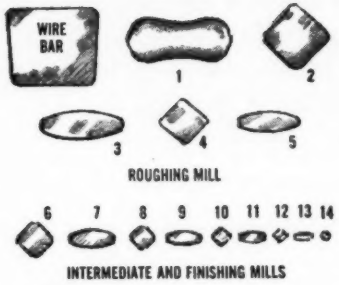



CONTINUED

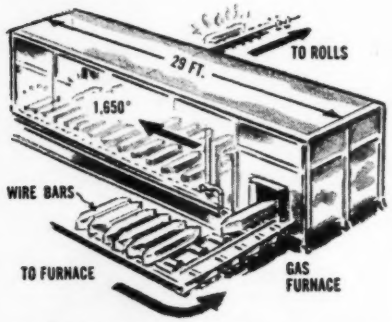
## *Wire-making starts in a rod-rolling mill*



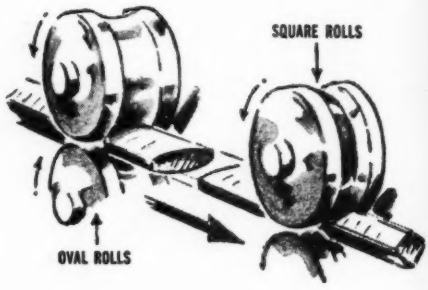

**THE JOB:** To turn 265-pound copper bars into 900-foot-long coils of 5/16-inch rod.




**THE METHOD:** Elongate the metal by squeezing it alternately oval and square in section.




**PREPARATION:** Heat the bars cherry-red in a furnace to make them soft and workable.




**FORMING PROCEDURE:** Slam the metal bars between rolls with crescent- and V-grooves.

these, heavy tongs called "dragons" alternately snapped at wire projecting through dies, and advanced it with short tugs. Rudolph's mechanized shop could fill orders for a *ton* of wire a week.

Last year, American plants spooled three-quarters of a million tons of copper wire alone. Fortunately this most-used metal is the easiest to draw.

***It's an electronic show.*** For a curtain raiser, go to Linden, N.J., where the Hatfield division of Continental Copper and Steel Industries has just opened the world's most fully automated rod mill. There, a single engineer sits in an elevated control center, the "pulpit," and holds the reins on an acre of machinery, with only two cranemen to help him.

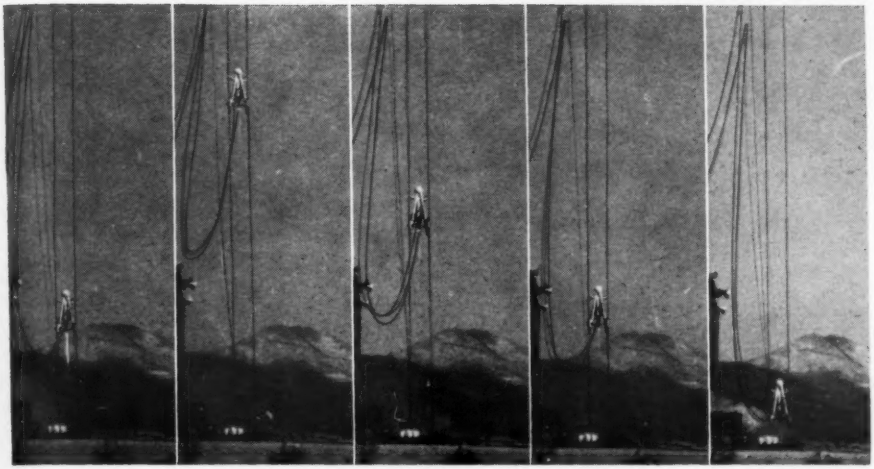
Into one end of the $3 million plant go 265-pound copper slabs called "wire bars." This is no ordinary metal. Because a single pound may eventually be stretched into nearly 20 miles of 44-gauge wire, it must be pure.

To make it that way, electrolytic refineries sandwich castings of conventionally smelted copper between thin sheets of highly refined copper. When the bundle is lowered into the electrolyte and direct current turned on, all the pure copper in the castings floats over and clings to the pure-copper sheets. These are melted down and recast in pans to form the wire bars.

***Metal dispatched like trains.*** In Continental's new rod plant, craneman No. 1 spots the 52-inch bars on a conveyer that pops one into a huge, gas-fired furnace every 27 seconds. There, "walking beams" hump up from below, inching the bars gently along. This prevents distortion as the copper soaks up 1,650 degrees of heat.

Each time a bar enters the furnace, another flashes out, glowing cherry-red and looking like an old-time interurban car. Almost at once, the bar slams between the five sets of rolls of a roughing

*[Continued on page 202]*



Going up . . . . . and up . . . . . then down . . . . . down . . . . . to land softly.

## Variable-thrust rocket lands softly

A rocket that can take off and land vertically under its own power has been developed by the Naval Ordnance Test Station at China Lake, Calif. It rises and descends on a NOTS engine fueled with liquids that ignite spontaneously when they come in contact with each other.

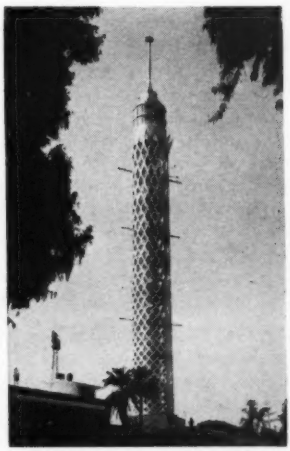
Thrust, from zero to 1,300 pounds, was controlled in the first test by an electric wire from the ground. Confined by guide cables, the rocket climbed when the thrust was greater than its weight, hovered when thrust equaled weight, and came back down when thrust was reduced. It landed gently on four automobile shock absorbers in its legs.

Further development may make it the means for soft landings on the moon.

**REVOLVING RESTAURANT** makes complete circuit every half-hour, giving diners a panoramic view of Cairo and environs.

### Skyscraper with mosaic facade

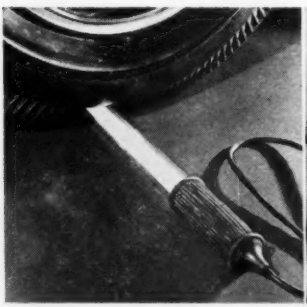
Though rated a modern engineering feat, the new 540-foot Tower of Cairo is designed to blend with the ancient Egyptian scene. The shaft is faced with an openwork lattice mosaicked with 12 million pieces of brilliantly colored tile. The structure is topped with a sightseeing crow's-nest and a revolving restaurant.



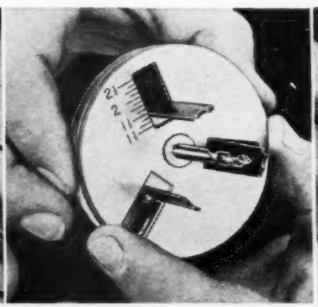
**TOWER OF CAIRO,** 540 feet high, is tallest man-made structure in Africa and Middle East. From it can be seen all of the city, the ancient Pyramids and Sphinx, and the desert beyond.

# Do-It-Yourself Camp Shelter

You and one helper can assemble this prefabricated camp shelter in a day. It's a dome-shaped rigid structure 22 feet in diameter and 12½ feet high made of triangular panels of plastic foam sandwiched between heavy water-resistant kraft paper. It bolts to a wooden-ring base, has a hinged double door, window openings, and ceiling vents. $345. Filtered Rosin Products Co., Baxley, Ga.



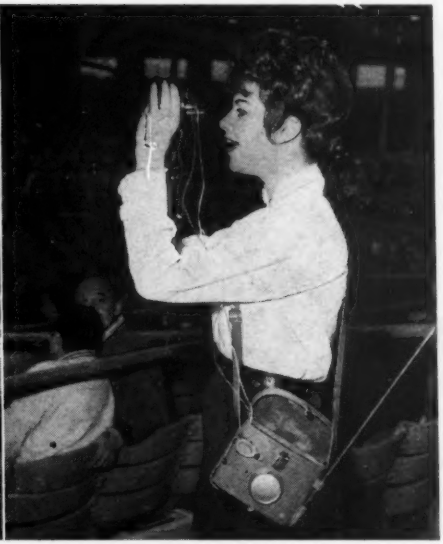
**TROUBLE LIGHT** is fluorescent tube enclosed in Tenite plastic shield that won't break even when run over by a car. Danish-made lamp has built-in semicylindrical reflector. With a 24-foot cord, it sells for $18.50. Technico, 122 Van Brunt St., Brooklyn, N. Y.



**HOLE CUTTER** fits hand power drills or drill presses with ¼-inch chucks. You adjust it for 1⅛- to 2½-inch diameters by loosening a nut and rotating an underplate. Z-Saw, with two blades for wood and metal, $4.95. Zoron, Inc., 612 W. Monroe St., Chicago.

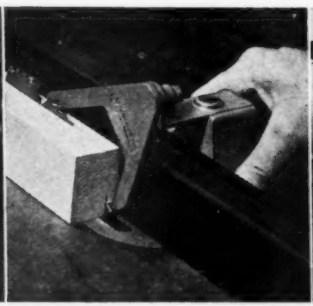
**CORNER POSTS** are fluted aluminum right-angle channels into which you glue or screw plywood to make a tight joint. They come in 8-foot lengths grooved to fit ¼-, ½-, or ¾-inch thicknesses. $2.88, $3.88, and $4.88. Reynolds Metals Co., Richmond, Va.

**TRAVEL KITCHEN** heats food on the road with hot water from the engine. You bolt Hot Box under the dash, attach car-heater hose to inlet in base, then recirculate water with a hose from outlet back to heater. Hamburger cooks in 19 minutes. $24.95. Newham Enterprises, 3946 Mission Blvd., Pomona, Calif.



**RADIO BINOCULARS** are four-transistor and seven-power combination to let you hear broadcast while watching a baseball or football game. Carrying case contains battery, collapsible antenna, and built-in speaker; or you can use earphones. $21.97. Al Monte, 1254 W. Jefferson Blvd., Los Angeles.

**FENDER MENDER** is a plastic aluminum that contains fiber-glass to give it additional strength for repair of dents and breaks in car bodies. It dries without heat; you can then machine or sand it smooth. Cost is 60 cents. Devcon Corp., Danvers, Mass.



**PUSH STICK** adjusts to sliding fit on rip fence. As you put stock through the saw blade, pressure on the rear arm of aluminum device is transferred to an upper lever and keeps it from rising on table. $3.98. Alson Mfg. Co., 937 N. Evans St., Pottstown, Pa.

**LEAK PATCH** of plastic-impregnated fabric plugs breaks in gutters and downspouts. You cut it to overlap hole, soak in solvent, and smooth on. Kit contains 4-by-24-inch patch and 4-ounce bottle of solvent. $1. Woodhill Chemical Co., 1390 E. 34 St., Cleveland.

CONTINUED

## WHAT'S NEW

**ADHESIVE FOOT RULE** sticks to a wood or metal tool, tackle box, or boat rail to give ready reference as you work. Idea came from PS's "I'd Like to See Them Make" [June '61]. Just peel off backing and press in place. In 12-inch strips, 50 cents each, three for $1. CarDar Co., 4506 N. Malden Ave., Chicago.

**BATTERY-CABLE ENDS** have positive grip that makes firm contact on terminals and won't slip. Prevention of leakage is said to give faster starts, stronger radio reception, steadier headlights, and longer battery life. Ends cost $1.25 each, $2.50 a pair. Radsco Cable Co., 4251 Galapago St., Denver.

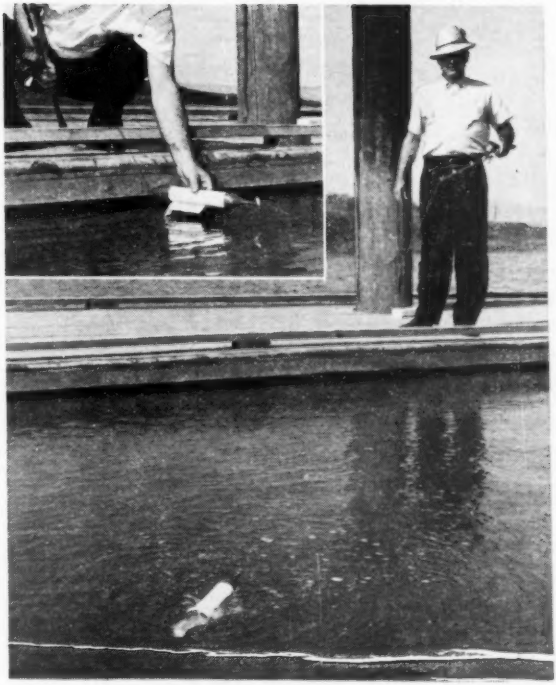
**BATTERY-POWER SHAVER** with twin rotary blades requires no outlet for use or recharging. It operates on two flashlight batteries in compartment at hinge of case and connected to shaver by retractable cord. Shaver has flip-up top for easy cleaning. Built-in mirror is fitted in lid of case. Norelco Sportsman sells for $19.95. North American Philips Co., 100 E. 42 St., NYC.

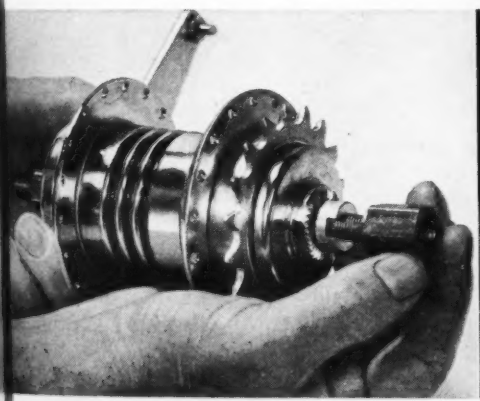
**HAND POWER DRILL** has bubble-glass level on housing to help you drill accurately at horizontal, vertical, and angled positions stepped at 15-degree intervals. Tool has ⅜-inch geared chuck and cord with a safety ground lead. It's rated at 2.5 amps and 1,150-r.p.m. load speed. With optional level, called a SpeedSight, it's priced at $22.95. Speed-Way-Thor, LaGrange Park, Ill.

## Line Caster Tows Bait Out to Fish

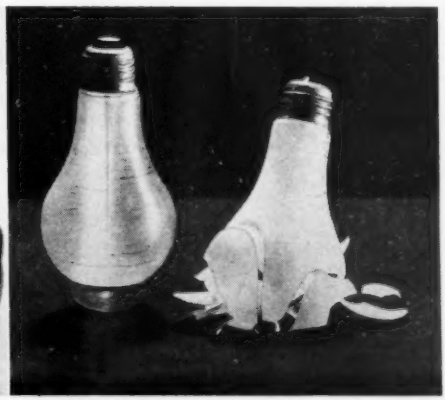
With this battery-powered, propeller-pulled float, you can troll without a boat; or it will haul bait from shore to any spot your line will reach. A flick of the line by the fisherman (operator?) starts the motor; another flick stops it and lets hook and lure or bait sink to any depth.

The Outcaster weighs seven ounces, is said to require no maintenance. Flashlight batteries last several days with normal use. Price, $9.75. Avocation Products, 430 Martin Ave., Box 624, Santa Clara, Calif.





**AUTOMATIC BIKE CLUTCH** is a two-speed transmission that changes gear ratio without cables or hand controls. You shift from hill climbing to cruising, or vice versa, by back-pedaling slightly (about two inches). The mechanism includes a brake; push back hard and the unit both goes into low gear and brakes. Cost, $14.95; installation about $2. Eclipse Div.-Bendix, Elmira, N.Y.



**SHATTERPROOF LIGHT BULB** is glass wound with fiber-glass yarn and bonded with a new silicone adhesive. It won't break, like ordinary lamp at right, when dropped, or even if dunked hot in ice water. Cooling crown at tip is said to lower burning temperature of filament, make it last longer. Flamescent lamp sells for $1.29 to $1.79. Duro-Lite Lamps, North Bergen, N. J.

# Hydraulic Jacks Will Raise Mountain to Save Rameses' Temples

***Italian engineers draft a fantastic plan to keep the Aswan Dam from flooding Egypt's 33-centuries-old monuments***

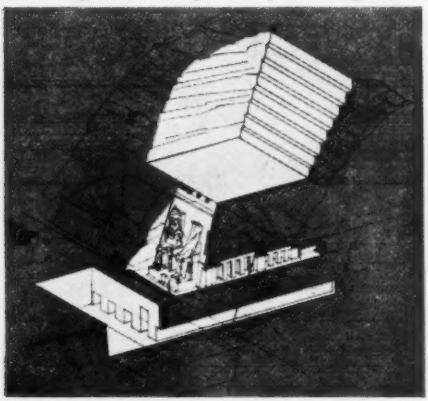
**By Joan Steen**

EGYPT'S dazzling temples of Abu Simbel may be saved from drowning in the Nile by a plan as breath-taking as the one that built them 33 centuries ago.

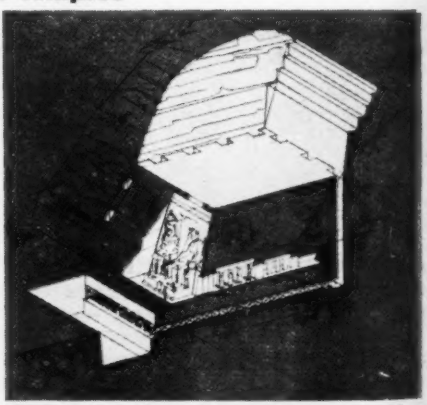
An Italian professor serving on a United Nations committee dreamed it up. The group had been called in to judge what could be done to stave off the flood that will be created five or six years from now by the new High Dam at Aswan. This bulwark, three miles wide and 225 feet high, will bottle the Nile behind it into an artificial lake 300 miles long. The water level will eventually rise 200 feet and swallow not only Abu Simbel, but a cluster of other

Quartet of Rameses'

***Four giant steps in jacking up the temples***

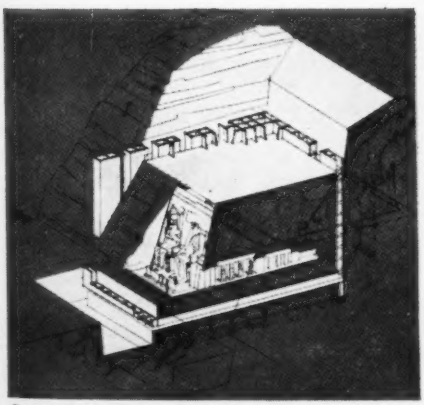


**1 MOUNTAIN TOP IS CUT OFF** so that the temples can rise. Tunneling begins in the rock underneath. Blasting is out; workers in touchy places will use nonvibrating tools.

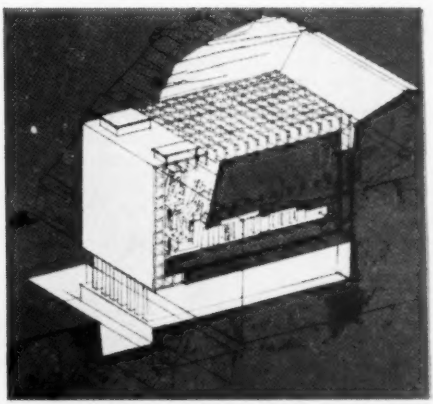


**2 BOX TO SHEATHE THE TEMPLES** gets under way with vertical excavations on three sides. Reinforcing ribs are added to its base—separated from the temple by a layer of rock.

statues dwarfs natives before Great Temple. The 67-foot colossi once lay buried in sand.

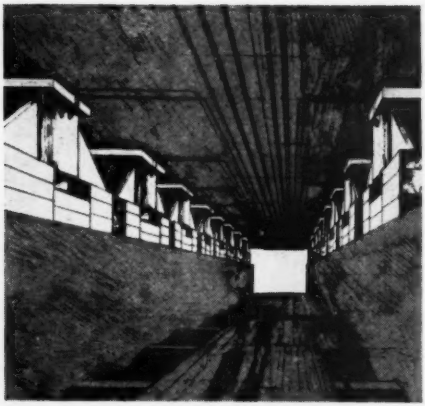


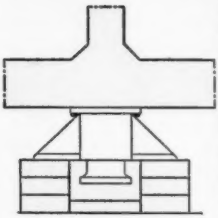
**3** **HONEYCOMB REINFORCEMENTS** are added to the sides, and the base is finished. Under it a second set of tunnels is begun. These will house the jacks and new foundation pillars.



**4** **UP SHE GOES**—slowly but surely. The jacks, pushing against the concrete pillars, inch upward. They will raise 300,000 tons (temple plus box) to a height of 203 feet.

CONTINUED





**ROWS OF JACKS** seen from inside look like a nest of pyramids. Side triangles rest on concrete pillars, which are built up a foot at a time as piston completes its stroke. Some possible modifications: spherical joints to insure balanced load, screw nuts, and more jacks.

ancient monuments that have crowned the Nile's banks since the times of the Pharaohs.

But the other monuments pale beside Abu Simbel's two temples. To preserve their magnificence, archaeology professor Piero Gazzola of Milan proposed an astonishing solution. Lift them up, said he. Raise the temples and reset them on foundations high enough to top the Nile at its new level.

Simple? There's only one hitch. The temples are carved out of a mountain. When Rameses II built them in the 13th century B.C. they were meant to be his masterworks. One temple was dedicated to the three most important Egyptian gods, Horus, Amon, and Ptah; the other to Nefertari, Rameses' queen. Fronting both are mammoth statues—marvels in their own right—because they too have been hacked out of the mountain. The larger ("Great") temple is 102 feet high and 124 feet wide. It runs 200 feet deep into the mountain. In one main chamber are still more statues, a mere 30 feet high compared with the 67-footers outside.

Lifting the Abu Simbel temples therefore means cutting out a solid hunk of mountain and elevating it 16 stories. It means lifting masses of up to 300,000 tons —larger than man has ever attempted.

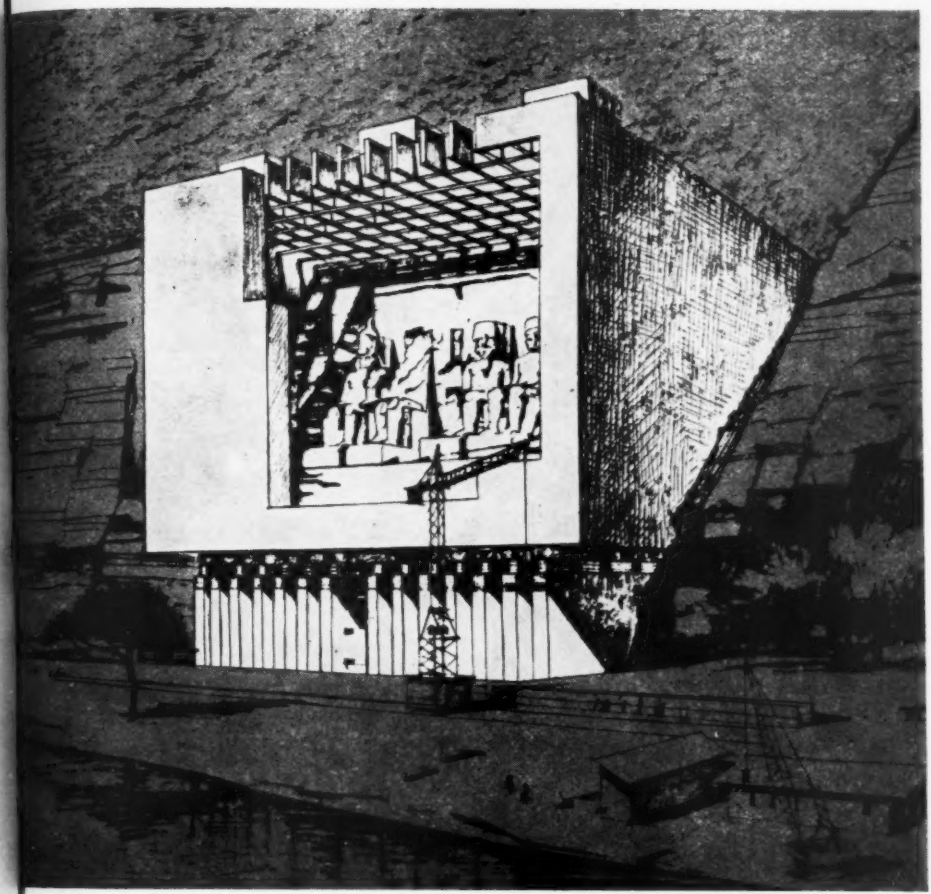
***Italian vs. French plans.*** Yet the idea appealed. When the plan was formally submitted by a combination of venerable Italian engineering firms and backed by the Italian government, it gained momentum. Two international teams of engineers were called in to study it—along with an alternative French plan for a dam to encircle the mountain—on the site itself. Their conclusions? A unanimous vote for the Italians.

Now that Egypt has officially adopted it, here's how the three firms—Italconsult, Imprese Italiane all'Estero, and Ing. Lodigiani—hope to carry out the lift:

First the rock mass above each temple will be removed, followed by painstaking excavations of the sides and bottoms (no blasting can be allowed). Each tem-

## *An earlier plan: Fend off the Nile with a dam 200 feet high*

**THE EGYPTIANS** first considered a dam for Abu Simbel. A French firm designed it and built the model at left. The deep-dish structure of sand, silt, and rock fill would have been set back 1,000 feet from the temple—enough to restore some view, including an artificial pool. But problems of water seepage, humidity, and maintenance led to a decision in favor of the lift plan. Another factor: The dam alone would have cost about $80 million.



**Lifting at rate of five feet a month, Great Temple's raising will take three years.**

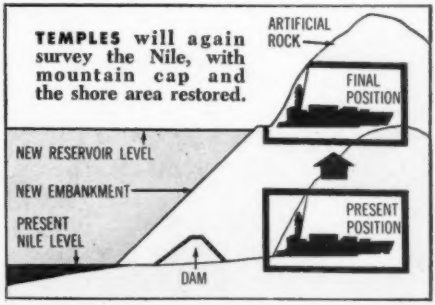
ple will then be encased in a shockproof box with a roof and front wall added to make a complete seal.

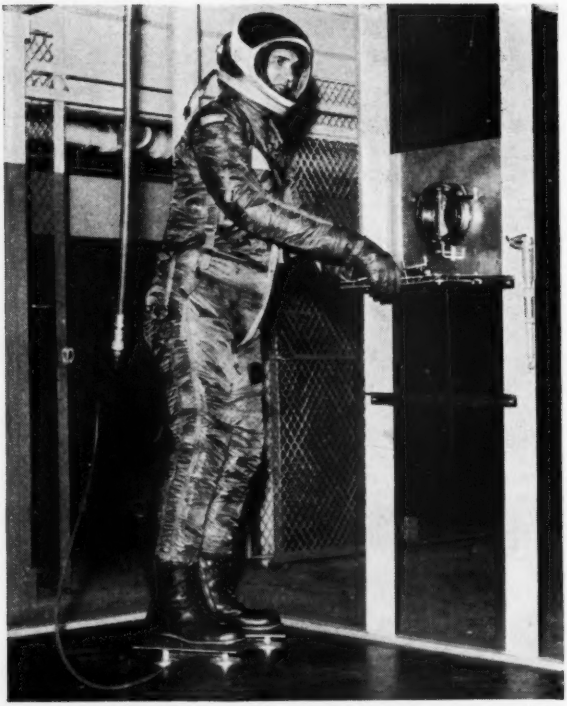
***Jacks-under-the-box.*** The muscle power for the hoisting will come from 308 hydraulic jacks set in under the box. Each jack will be placed upside down under an intersection of reinforcing ribs in the floor of the box. The pistons will then press downward against prefabricated pillars.

To make the lifting operation as safe as possible, electrical controls will insure that the jacks work simultaneously or not at all. And their action will be irreversible: The pistons will retract only when the pillars under each jack's "wings" are built up with concrete to support them.

But the engineers' chief nightmare is not that the jacks will slip and fail to

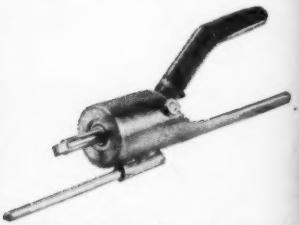
*[Continued on page 206]*





**"AIR SKATES"** make experimenter as free to move as if he were weightless while using space tool. Compressed air from hose issues from disks beneath foot plates to make them frictionless, simulating one condition of space environment.

**"PLENCH"** is a ratchet socket wrench with handles like pliers so you can squeeze instead of twist. Pin projecting from side engages hole in panel being worked on, to brace both the tool and user against being turned the opposite way.



**SCREWDRIVER** has square end instead of conventional tapered one. It enters similar-shaped socket in head of special screw so no pressure is required to hold it in slot, while projecting pin braces it. Squeezing the handles turns the blade.

## New tools designed for weightless work

Twist a screwdriver and you may turn instead of the screw—if you're weightless in space. Assembling or repairing vehicles and platforms in orbit will take special "space tools." What they may look like is shown by these two early experimental models, developed at the Astronautics Division of Chance Vought Corp., Dallas, Tex. They correspond to the wrenches and screwdrivers we use on more solid footing. To test tool action—and reaction—in space, technicians wear special shoes that are frictionless on a layer of compressed air.

### New tiny London taxi

A fleet of 200 bright-red French-built minicabs is being tried out in London. One of the new Renaults is shown at left standing beside a traditional high-roof London taxi.

The new cabs carry advertising on the side, are cheaper for riders: a straight shilling (14 cents) per mile, while the old ones cost the equivalent of 24 cents for the first mile and 18 cents for additional ones.

DOUBLE-LENGTH FEATURE OF
TRUE SCIENCE ADVENTURE

# "Runaway Engine on the Main Line!"

*Late in the evening on November 12, 1959, a 123-ton ghost engine roared out of control down the main-line tracks of the Jersey Central Railroad. What happened in the next 36 minutes was to become one of the wildest adventures in railroading history.* By E. D. Fales Jr.

DOUBLE-LENGTH FEATURE OF TRUE SCIENCE ADVENTURE

AT 10:29 p.m., a warning bell sounded in HY Tower overlooking the huge, sprawling terminal yard that forms the eastern end of the Jersey Central Railroad at Jersey City. Towerman Joe Hilinski looked up, startled. The bell was the five-second warning that a train was approaching his tower. It shouldn't have sounded. No trains were moving in the yard.

Hilinski, sturdy, solemn, one of the road's best signalmen, spun around to his model board—the 12-foot track diagram on the wall. For a moment, he was reassured. Not a track on the board was lighted.

Then suddenly a tiny white bulb lighted up on Yard Track 9. This is a busy throat track on which most of the big freights leave the yard to enter the main-line tracks. HY Tower stands at this junction. It is Joe Hilinski's job to switch the freights in and out of the yard and keep them from tangling with fast passenger runs on the main line.

*At 10:28, an unseen hand moved toward the throttle in this 1,600-hp. diesel, No. 1706, and 123 tons of rampaging steel roared off toward disaster.*

Until that light winked on, it had been a quiet night. All trains on the Central's 600-mile line were running on time—with one exception. The New York Clocker, a crack passenger express eastbound from Harrisburg, was 30 minutes late. Nothing else was due to pass Joe Hilinski's tower for half an hour.

Still the tiny light persisted. Something was coming on Yard Track 9. Hilinski peered out into the darkened, silent yard and saw only the shadowy shapes of parked trains. There were no lights, nothing moving. He felt his flesh start to creep. The yard was still.

Or should have been.

*In HY Tower just outside Jersey City signalman Joe Hilinski stared in horror as a dark mass hurtled past his window—bound for the main line.*

THE Jersey Central is one of America's oldest and proudest railroads. It consists of a four-track main line running west to Pennsylvania and a stubby branch line cutting south along the Jersey shore.

At the eastern end of the main line is the ancient, echoing Jersey City Ferry Terminal. From New York, across the Hudson River, come creaking passenger ferries filled with commuters and huge railroad ferries carrying whole freight trains. Alongside the ferry terminal lies the mammoth 40-track marshaling yard, one of the world's greatest, over which Towerman Joe Hilinski stands guard. Here trains are made ready for such faraway points as Milwaukee, Dallas, and San Francisco. Beyond the yard's oil-blackened gloom rises a magnificent view of the Statue of Liberty, just off the Jersey shore.

Ordinarily everything runs smoothly in this complex, efficient rail operation. This disaster-charged night was destined to be different.

Joe Hilinski peered again into the blackness. In the shadows of Track 9, he suddenly spotted a dark mass, moving fast. As it neared, he made out the shape of a locomotive, all lights extinguished, running backward. From the roaring

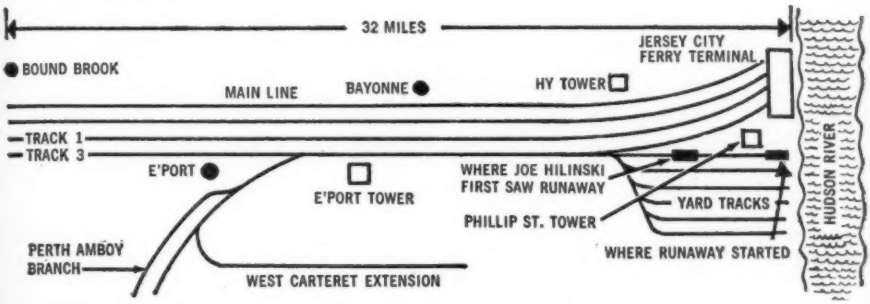
sound, Hilinski knew it was being driven at full throttle.

"She's going to hit the derail," he gasped. This is a heavy iron wedge kept clamped to one rail to derail any runaway freight car before it can roll out onto the main line. It would dump the engine right below Joe's window.

Either some train crew had gone mad, Hilinski thought—or he had. Outside his tower there was a clattering crash. The locomotive came to the derail—and the impossible happened. It went right over it. Each wheel sprang eight inches into the air and landed back on the rail. Then the engine blasted through the switch set against it and was out on Main Line Track 3.

Hilinski, stunned, shouted an urgent and seldom-used command into his phone:

"Hold on three!"




THESE events had occupied less than 25 seconds. Two miles away, Joe's warning cry rang out over loudspeakers in the dispatcher's office atop the huge ferry terminal. Here it was heard by Joe's brother, Assistant Chief Dispatcher Frank Hilinski, the night boss. Flanking Frank's desk were his two train dispatchers—John Messenger controlling the high-speed main line west, and Gilbert Snell, the branch south.

"What's wrong?" demanded Frank Hilinski. His brother's frantic order to "hold" meant to stop all trains on Main Line Track 3—a drastic step on a busy 60-mile-an-hour thoroughfare.

Joe's voice shook. "You have a runaway engine, traveling fast."

"Who is he?"

"I don't know. He was all dark."

"Which way is he headed?"

"West—against traffic."

Brother Frank Hilinski jumped up. A dozen freights and passengers were rolling on the main line within 30 miles of the terminal. Frank's first thought was for the nearest—the late-running Clocker express.

If she had been on time, she would already be safely in the terminal. But she wasn't. A quick check showed she was on Track 1, coming fast and due to stop at Bayonne in about four minutes.

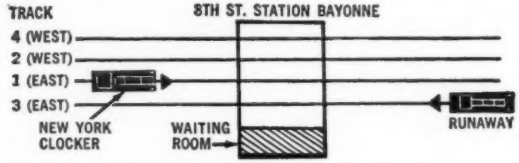
ABOARD the Clocker, passengers bound for Bayonne were already busily checking coats and luggage. It was a good night. They would be home soon. They had no way of know-

CONTINUED

DOUBLE-LENGTH FEATURE OF TRUE SCIENCE ADVENTURE

ing that death stalked them on the rails only four minutes away.

As with most railroads, the Central's tracks are even-numbered westbound and odd-numbered eastbound. The lowest numbers are the fast inside tracks. The track plan at Bayonne thus looked like this:




While the runaway was on Track 3, adjacent to Track 1, it would slam through Bayonne just as passengers at the station would be swarming to and from the stopped Clocker across the outside track. If the engine ploughed into the crowd . . .

FRANK HILINSKI quickly ordered Bayonne Tower to try to stop the Clocker before she could enter the station. He also phoned Bayonne yards.

"There's a runaway engine coming your way," he told the startled yardmaster. He ordered him to set flares. "Throw one into the cab if they don't respond," he said. "We don't know what's wrong with the crew."

*Anything*, he knew, could have been wrong. Perhaps the engineer had fainted, with his foot still heavy on the deadman's pedal, and the fireman had been thrown off when the engine hit the derail. Maybe someone, drunk or drugged, had stolen the engine, or a madman was holding the crew at gun point.

*At the railroad's nerve center atop the ferry terminal, Night Chief Frank Hilinski (right) huddled with his two dispatchers, John Messenger (center) and Gil Snell (left). They had a desperate decision to make.*

Hilinski consulted his train chart, hoping to have some towerman route the engine to a safe track before it could cause disaster. But every track was blocked by moving trains.

The phone rang. The Bayonne yardmaster reported back. "Your engine by here at 10:34. He refused to obey my signals and never even slowed down." The hurled flare had caromed off the cab. No face had been seen at the window.

At 10:35 p.m. the runaway, having covered four miles from HY tower in five minutes, charged without warning through Bayonne station. Passengers waiting for the Clocker, now stopped safely outside the station, heard the apparition and scattered in fright. No one was hurt. Had the Clocker been in the station, the runaway would never have been heard.

West of the station, the crew of the halted Clocker were astonished to hear an engine, all dark, roar past on the wrong side and vanish into the night.

IN THE next 90 seconds, Frank Hilinski did some of the fastest thinking of his life. The train chart now showed that the runaway was speeding toward a head-on collision, in

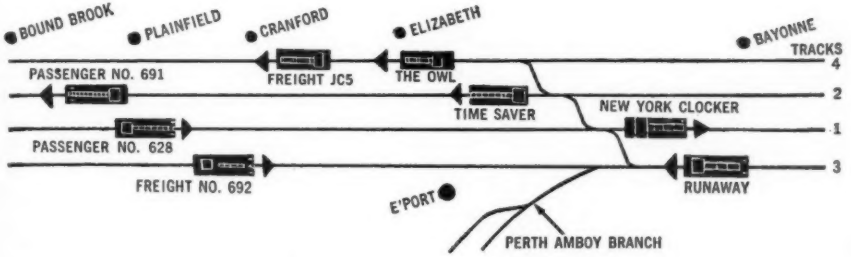
about 18 minutes, with No. 692, a freight rolling east from Bound Brook.

10:36 p.m.—a call from Bayonne tower: "We identified your runaway as she went by. She's engine No. 1706. Still no lights. Cab dark. Can't see crew."

So that was it. No. 1706, a huge Fairbanks-Morse diesel-electric, was a single-unit workhorse assigned to yard duty and sometimes to road service. She was painted dark green, with two gold tiger stripes on her nose. She weighed 123 tons, developed 1,600 horsepower.

Hilinski's mind focused on saving that eastbound freight. He *had* to get the engine off Track 3 somewhere. But where?

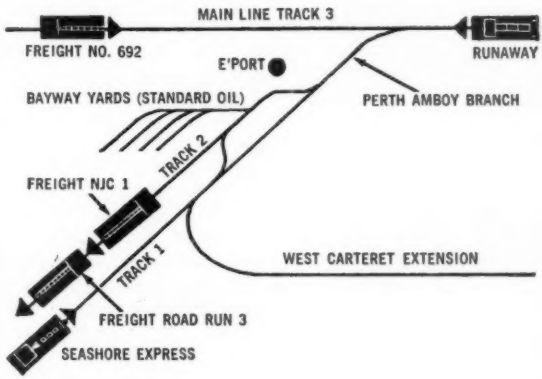
Here was his train layout at 10:36 p.m.:




THERE was an eastbound freight on Track 3 and an eastbound passenger on Track 1. Those tracks were both out. On Track 4, a local westbound passenger, the Hampton Owl, was making station stops and would be overtaken if the runaway were put on that track. Track 2 was also out, being occupied by a westbound freight, the Time Saver, due to slow down at Bound Brook Junction.

Hilinski turned to the branch line. This is essentially a two-track line, called the Perth Amboy Branch, or just the Branch for short. It swings away from the main line at a busy junction known as E'port (short for Elizabethport).

Both tracks were blocked. A Pennsylvania seashore express was barreling north on Track 1. Two freights were plodding south on Track 2. Here was the situation on the Branch:




SOMEONE suggested ditching the engine on a factory siding. Hilinski vetoed the idea. It would mean death for anyone aboard. Frank had noted, however, that the upper 12 miles of the Branch were clear. Tower reports showed that runaway 1706 was averaging 40 m.p.h. It would be 30 minutes before 1706 could overtake the two freights.

Hilinski, a short man, almost shy, with a shock of unruly

CONTINUED

DOUBLE-LENGTH FEATURE OF TRUE SCIENCE ADVENTURE

white hair, reached for his mike and made the most important decision of his railroading life. With only two minutes to spare, he ordered E'port tower to send the runaway hurtling down the Branch on southbound Track 2.

HILINSKI now had time to phone Division Superintendent Joseph Galuppo at home. The phone awakened Galuppo. A normally calm man, he became in the next half-hour, he later testified, almost a nervous wreck.

Hilinski stated the situation briefly. Should he shunt the runaway into a short industrial spur off the Branch?

"Cripes, no!" roared Galuppo. The turn was very sharp and the engine might well go over. If it didn't, it would slam past an unguarded grade crossing and possibly ram a factory filled with workmen or tanks or cars loaded with gasoline, chemicals, even munitions. That was out.

Galuppo was now in a multiparty phone hookup. Someone cut in: "Open Raritan River Draw and dump the engine into the river?" Again came the superintendent's "No!" Barges filled with propane used the draw. An engine smashing onto a propane barge could set off a devastating explosion.

There was now a suspicion that at least the runaway's engineer, a man named Gunther, might still be in the cab. His fireman had been located at home, but Gunther couldn't be found. Had he gone back to his engine for something and been overpowered by a prowler? Galuppo couldn't risk dumping the engine for fear the man might still be aboard.

10:39 p.m. E'port tower was reporting: "Runaway by here. Passing her from Main Line Track 3 to Branch Track 2."

*Superintendent Joseph Galuppo. Roused out of bed, he had a daring idea: Try catching the runaway with a chase engine.*

At this moment, a foreman at the E'port engine shops, John Rusbarsky, heard the runaway coming. He ran across six tracks and crouched to grab the locomotive's emergency fuel shutoff valve—a small trip ring on the side that can be pulled to cut off fuel in case of fire. He lunged and missed.

Suddenly Superintendent Galuppo, still on the phone with Hilinski, had a daring idea. "Call ahead," he said. "Tell them what's coming and see if they can get an engine out ahead and grab onto him."

Hilinski caught his breath. The dramatic plan would involve grave risks. He would have to switch the runaway around the two southbound freights—and at the same time keep her from ramming the northbound express.

10:40. A tower along the line reported sparks from one of the runaway's wheels. This was puzzling. It might mean that the handbrake—which works on a single pair of wheels—was on. Who had put it on?

Still on the phone, Hilinski could hear his branch dispatcher, Gil Snell, saying in his other ear: "We got an engine of our own on the Barber Drill with radio, Frank. Maybe we could get it out ahead of the runaway."

Barber Drill is a big yard where cars are "drilled," or sorted. But the runaway would race past the Drill in the next few minutes—too soon to get an engine moving out ahead of it.

Hilinski flashed this information to Galuppo. Galuppo snapped: "Then let's also have that engine chase the run-

away *after* he goes by! Tell him to try to catch him, couple on behind, and drag him to a stop. And tell him to *forget about signals.*"

A frightening net was about to tighten. If the plan worked, runaway 1706 would be trapped between two engines both frantically trying to catch it. The whole thing seemed fantastic. The stage was being set for one grand—and deadly—pileup.

TWENTY miles ahead, at Long Branch, N.J., Galuppo's desperate call for an engine reached Trainmaster Ed Jeffrey, a quick, tough, joke-telling man whose caustic quips are good-humored but rarely printable.

"Who can we get out?" he snapped at his night dispatcher, Ed Witik. "Where is Road Run 3 right now?" This was the first of the two southbound freights on Track 2.

"Just entering our territory at Perth Amboy," said Witik.

"Where is 728?" This was the northbound seashore express on Track 1.

"Just leaving Perth Amboy."

For the next few minutes, Jeffrey—wisecracking all the way—alternately cursed, goaded, threatened, coaxed, and sweet-talked his men. "For God's sake," he barked, "have the South Amboy agent try to catch the express and hold him in the station. And—quick—get me Raritan Draw."

Jeffrey had the manner of a man to whom trouble doesn't often dare happen.

*Trainmaster Ed Jeffrey, barking orders over his dispatcher's shoulder, had an inspiration: Use the express's headlamp as a searchlight.*

AT THIS moment, Road Run 3, the big 41-car freight, was approaching the Raritan drawbridge. In command of her engine, No. 1506, was Engineer Chet Gudmunson, a small, gentle, white-haired man. Gudmunson had relinquished his seat to his fireman, Harold Johns, who was taking a hitch at the throttle. Also riding the engine was Head Brakeman Leo Barry, a man with fists as big as couplers.

Barry and Gudmunson were old-timers, gray, tanned, fit. Fireman Johns was younger, a tall, strapping, handsome man. Johns had cut his speed to the 25-m.p.h. bridge limit when he saw a waving lantern and braked to a stop. The bridge captain shouted:

"Your engineer is wanted on the phone in a hurry."

Gudmunson climbed down and ran to the bridge phone. A voice said: "Don't interrupt. Just listen. Seconds count."

The voice—it was Jeffrey's—now stated that a runaway was coming and that the towerman hoped to switch it around Gudmunson's train.

Then came the orders that shook Gudmunson: "We'd like you to get on the track ahead of the runaway. Cut off your train. Proceed immediately to the straight track at South Amboy. When you see him coming up behind, match his speed, then slow down, let him bump you, and force him to stop."

Gudmunson tried to ask a question.

"Get going," said the voice.

CONTINUED

DOUBLE-LENGTH FEATURE OF TRUE SCIENCE ADVENTURE

Despite the tone, Gudmunson knew he was being asked, not ordered. This was beyond the call of duty. With retirement coming and a wife at home, he didn't have to risk his life. Neither did Johns or Barry.

There was a bare second's consultation. They'd all go. Then the red signal flashed to green, and Gudmunson took it.

Bound for the unknown.

BY THIS time, Hilinski in Jersey City had all towers and Trainmaster Jeffrey on a single phone circuit. Up and down the line, everyone heard these reports in quick succession:

10:53 p.m., from South Amboy tower: "Gudmunson passing southbound, moving slowly, 10 miles an hour."

10:54, from Barber tower: "Runaway by here fast on Track 2. Speed is 45."

10:55, from Woodbridge tower: "I just switched runaway over to Track 1. She nearly dumped, but she made it."

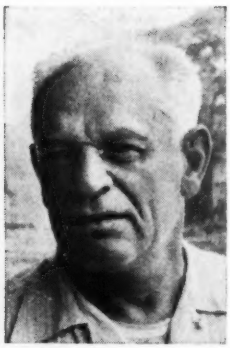
Then at 10:58, from South Amboy tower, disturbing news: "Gudmunson has stopped!"

At this moment, the runaway was only a mile away.

GUDMUNSON was worried. He had proceeded slowly to the straight track at South Amboy, as ordered. Then, feeling a desperate need for more information, he had stopped at a trackside telephone.

There had been no time for the voice at the bridge to tell Gudmunson one important fact: The runaway was running dark. So the three crewmen, staring back into the empty blackness of a tunnel through which they had just passed, were all watching for something they would never see: a headlight.

Gudmunson had other worries. His engine, like the runaway, was riding backward. Its long snout made it impossible to see the track behind on curves. He had also been warned at the bridge about the second engine from Barber Drill chasing the runaway from the rear. He knew it would be charging down the line, disregarding signals. Even if he did stop the runaway, the Barber Drill engine might ram them both.



*Head Brakeman Leo Barry sounded a crucial warning just before the two engines hit: The runaway was closing too fast.*

THE Barber Drill engine, No. 1504, was having its own problems. Fitted with automatic train control, she kept running into red signals thrown up by the runaway ahead. While the automatic braking device can be manually disconnected, her engineer, Bill Fox, still had to slow down at each red and acknowledge the signal by pushing a button in his cab. This was costing valuable seconds. Between signals, Fox was putting on furious speed bursts. He was only a minute or so behind the runaway.

At the bridge, the remaining crew on Road Run 3, mystified at being left behind by their engine, heard a roar behind them and saw fire and sparks. At 10:57 p.m., the runaway skinned past them on Track 1 and rumbled across Raritan Draw. The conductor shuddered at the thought of the upcoming express.

But ahead of the runaway, a switch slid and locked. The

runaway's speed tape later showed that she hit this 10-mile switch at 46 m.p.h. She lurched, leaned over hard, made a slamming turn, and settled down. She had been switched around the stalled Road Run 3 and was now back on Track 2.

The passenger train was safe. But the runaway was only a half-mile from Gudmunson and his crew, waiting unaware by their parked engine. The situation was now as shown on the track plan at right.

WHEN Gudmunson stopped, Brakeman Barry went to the track phone for instructions. Ahead, to the south, Gudmunson could see the express lying in South Amboy station with its headlight blazing. Normally, it would have been dimmed. Gudmunson didn't know that quick-thinking Jeffrey had ordered the engineer: "Keep your light on so it will shine on the runaway."

Peering at the darkened tunnel, Gudmunson and Fireman Johns suddenly saw, at the same moment, the faintest glimmer of shaking glass. What they were seeing was the dim reflection of the distant express train's headlight in the runaway's dark windshields. It was just enough to show two gold tiger stripes. The runaway was right on them.

Johns shouted for Barry as Gudmunson was already reaching for the throttle. This type of throttle is not notched. It is "direct pull." But you don't open any locomotive throttle fast. Gudmunson eased the lever back an inch. No. 1506 crept ahead. Then he gave her quarter throttle and she began to roll. Within 10 seconds, he risked half-throttle, and the engine shook.

The runaway had now increased its speed to 47 m.p.h. This meant Gudmunson would have to do at least 60 to get a safe margin before he slowed. His engine was a 1,500-horsepower opposed piston, a little lighter and less powerful than the runaway.

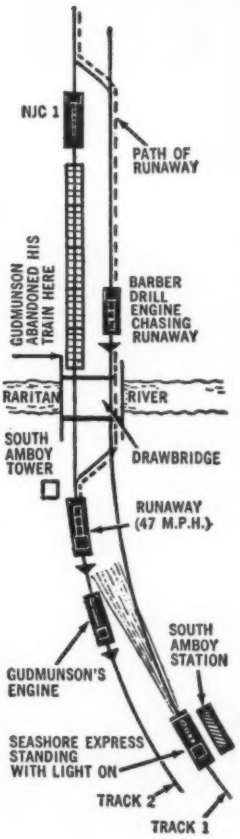
No matter where you put the throttle, a diesel builds up power slowly—you can't rush it. Then, around 35 m.p.h., if it has no cars to pull, it takes off like a scared deer.

When his speedometer said 35, Gudmunson gave full throttle. Oil now flooded No. 1506's eight blazing-hot cylinders. To get traction, Gudmunson flipped the sand lever to coat the rails. At the same time, he had been working the transition lever forward, which is like shifting gears in a car. The lever was now at its highest ratio.

They flew past the express waiting in South Amboy station. Gudmunson was thinking: "I've got to do it now." Just ahead lay a sharp S-curve. If he got into the curve he'd lose sight of the glimmering object behind him. His speedometer read 45 and was still climbing.

AT ABOUT 11 P.M., with his speed at 60, Gudmunson began shutting down and valving air. The runaway was dangerously close.

Head Brakeman Barry thought Gudmunson slowed too much. Big-fisted Barry, whose voice has a rich burr, shouted: "Hold on hard—it's going to ram us." Gudmunson, seeing his mistake, yanked the throttle open. If the impact threw his foot off the deadman's pedal, his brakes would




CONTINUED

DOUBLE-LENGTH FEATURE OF TRUE SCIENCE ADVENTURE

*Engineer Bill Fox, in the second chase engine, tried desperately to catch the runaway, but was slowed, ironically, by his own automatic safety brakes.*

lock and his engine might cartwheel in front of the heavier runaway. Brakeman Barry had another thought: the couplings. Would the knuckles meet? If not, both engines could be derailed.

Under full throttle again, No. 1506 leaped ahead—but too late. The runaway hit her. The collision was deafening. Steel motor-hood doors all along the catwalk burst open. Barry and Johns were nearly knocked from their seats. Gudmunson stamped down hard to hold his foot on the deadman's pedal. No. 1506 struggled to keep her feet.

Gudmunson felt the runaway's massive push. The couplers had met and locked. He shut off power and grabbed the sander, but was afraid to apply hard brakes. He shouted to Johns: "Get over on her and shut her down! When you have control, turn on the cab light as a signal."

Johns, holding the handrail, crept back along the rocking catway. The heavy steel doors—10 of them—kept slamming in his way. He closed each door. Then, flashlight in hand, he swung to the other engine. There was no elbow at the window. There was no one in the cab.

Then he flashed his light on the controls. Everything was perfectly set for running: throttle pulled back full, reverse gear in reverse position, air brakes set for running. The isolation switch—which can cut generator power from the wheel motors—was on.

He shut the throttle and heard her die. Then he set the brakes and flipped on the cab light. Instantly he felt Gudmunson apply full braking power and wrestle the runaway to a halt.

The two engines slid to a stop in a cloud of hot sand and smoke so dense that Johns could scarcely breathe. The runaway's No. 3 wheels, on which the handbrake worked, were cherry red, the brake shoes nearly in flames. Johns thought the traction motors were on fire, but didn't wait to see. He grabbed a red and a white lantern and ran back along the track. He could see the first glow of No. 1504's headlight. The situation was now as shown at left.

THE chase engine from Barber Drill was at this point close behind and coming fast. At 11:04, Engineer Bill Fox saw John's waving lights and shouted into his radio: "Something's happened. I'm getting a flag." He brought his engine to a shuddering halt just in time.

Gudmunson ran toward him and swung up into the cab. Fox pointed to his radio phone. Gudmunson's legs were shaking. He lifted the receiver and all along the line, from Jeffrey at Long Branch up to Hilinski at the ferry terminal, they heard his voice:

"This is Gudmunson, Road Run 3. We got her."

"How's her crew?" someone asked.

"Crew?" said Gudmunson. "She's got no crew. She's a bloody ghost."

THE mystery is now two years old and still unsolved. The FBI and New Jersey's able Public Utilities Commission (P.U.C.) immediately investigated. The runaway's missing engineer had eventually been found safely at home after the near disaster, blissfully unaware that his rampag-

ing charge had given one of America's finest railroads a fright it will never forget.

The runaway had been parked, awaiting a new crew, with its engine idling. The P.U.C. wanted to know why. This, explained the railroad, is standard practice, especially in cold weather, to keep the engine warm. The locomotive had then taken off within two minutes of the time her crew had left her. What happened in those two minutes?

Several theories were considered—and exploded. Had someone tried to steal or wreck the engine? There were no clues, no fingerprints. Besides, it would have taken an expert to know the complicated starting procedure.

Had the throttle vibrated open by itself? This has been known to happen on some engines, but P.U.C. tests showed it couldn't have on No. 1706. Even if it had, who shifted the engine from neutral to reverse, released the air brakes, put the isolation switch on "run," and shifted the transition lever to "low ratio"?

Had the runaway been carelessly parked? Her crew, all veterans with good records, testified they had carefully gone through the eight-step shutdown routine. Engineer Al Gunther had then set the handbrake himself, he said, giving it an extra shove with his foot to tighten it.

Nothing that could have happened accounted for what actually did happen. One safety precaution resulted. At the P.U.C.'s suggestion, locks were installed on the reverse lever in all engines, like the ignition lock of a car. With the lever locked in neutral, the engine could be idled—but not moved.

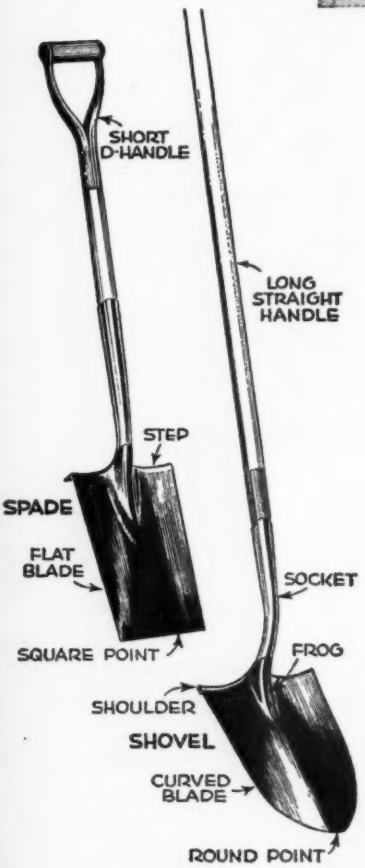
The strange case is still officially open, but many railroaders think it may never be solved. The P.U.C. commended Gudmunson, his crew, and others for their bravery. It was a night of many heroes. If Joe Hilinski hadn't first spotted the runaway before it hit the main line, if his brother Frank hadn't made the bold shunt down the Branch, if Superintendent Galuppo hadn't conceived his daring chase scheme, if wisecracking Ed Jeffrey hadn't thought to keep the express's headlight on—if towermen and yardmen and trainmasters and ticket agents all along the line hadn't done their jobs . . . Many ifs—many men.

The runaway had covered 22 miles in a frightening adventure that lasted exactly 36 minutes. You can see her today, plodding the yard at Jersey City, strangely docile and content. For a brief moment, those who tamed her ghost—ordinary men with ordinary jobs and ordinary homes and ordinary problems—had become miraculously un-ordinary men. ■ ■

*Heroic No. 1506 as she appears today, her wounds healed, and wearing a fresh coat of paint. Engineer Chet Gudmunson (with cap) and Fireman Harold Johns were cited for bringing her safely through the daring exploit.*

# Mechanics and Handicraft SECTION

**PRESIDENTIAL BACKACHE** started with a shovel at this now-famous tree-planting ceremony last spring at Ottawa, Canada. To right of President Kennedy are Canada's Governor General, Georges Vanier, and her Prime Minister John Diefenbaker.




# The Right SHOVEL for the Job

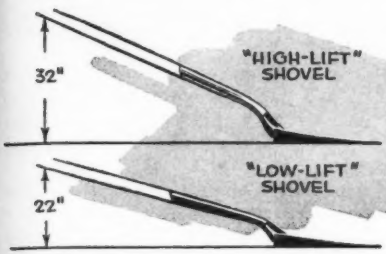
**By George Daniels**

THE most publicized backache in history started with a shovel. It happened just recently to the President of the United States, John F. Kennedy, as he took part in a simple tree-planting ceremony.

Every year, thousands of less celebrated but just as painful backaches are caused by using the wrong shovel for a job—or the right one in the wrong way. Do you know, for instance, whether your shovel should have a high lift or a low one? A deep hang or a shallow one? Or whether it's not a shovel at all you need but really a spade? Such terms may sound unfamiliar, but they can make the difference between easy yard work and the aching back, blistered palms, and worn-out feeling that go with the misuse of tools or the wrong tools.

Shovel work really begins at the hardware store. It takes 120 pounds to push a standard blade into average soil. For many people, this means using nearly their full weight just to drive the tool. Shopping for the right design—and knowing how to use it correctly—can make the

## *Finding the "correct" shovel: It's got to match your needs*




**CHECK FOR "LIFT"** by measuring distance from handle tip to floor with blade held flat. It should be at least 32″ for a good high-lift shovel, no more than 22″ for a low-lift type.

**YOU WANT LOW LIFT FOR DIGGING** as it permits handle to remain comfortably upright as you drive blade vertically into ground. High-lift handle throws you forward, off balance.

job go more easily than you might think.

***A shovel's "lift"*** is the angle that the handle makes with the blade. The higher the lift, the sharper the angle. For *digging*, you want low lift so you can press the blade straight into the ground and still grasp the handle comfortably. A high-lift handle forces you to lean too far forward, throws you off balance, and tires you. For *shoveling*, such as spreading earth, sand, gravel, and other materials, you want a high-lift handle so you can slide the blade flat along the ground without stooping.

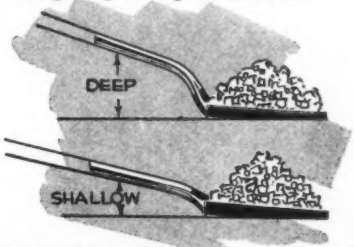
To check for lift, hold the shovel's blade flat against the floor with your foot and measure the distance from the handle tip to the floor. For digging, this should be no more than 22″ for long-handled shovels of about 58″. For shoveling, you want at least 32″ to put the handle at a comfortable height.

***"Hang" is the distance*** the blade is dropped below the handle line by the downward curve at the joint. You want a deep hang for horizontal shoveling and material moving. It lowers the load's center of gravity and helps—like a pendulum—to keep the blade from tipping sideways and tiring your wrists.

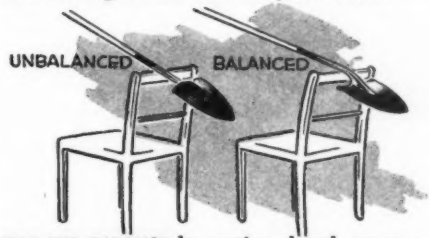
You don't want a deep hang, however, on a digging shovel; it would be harder to control. The off-center blade is more likely to wobble as you press it into the ground and to tip as you lever it out. It's also more awkward to get a good down-thrust on the blade.

***Try the balance, too.*** Rest the shovel across a chair back like a seesaw. If it is correctly balanced, the blade will remain

**YOU WANT HIGH LIFT FOR SHOVELING** as it lets you slide the blade along the ground without bending over. A low-lift shovel makes you go into a tiring stoop to keep the blade flat.



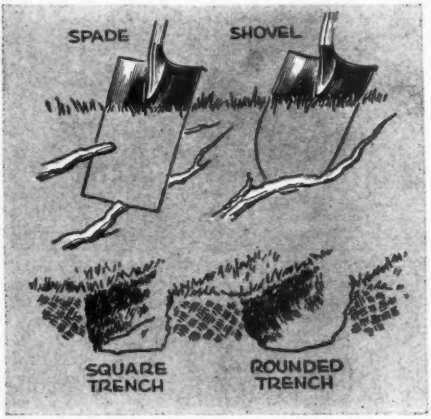

**LOOK FOR BLADE "HANG"** when choosing between digging and shoveling. For shoveling, a deep hang is low and stable. For digging, a shallow-hang blade is less likely to wobble.




**TRY THE BALANCE** by resting shovel across a chair back or other support. Blade should remain upright. If it flops over, it is unbalanced and will twist uncomfortably in your hands.

CONTINUED

## Do you need a shovel or a spade? To tell, check the job




**ROUND-POINTED SHOVEL** pierces ground more easily, is best for general digging, especially in hard or rocky soils. Square-edged spade severs roots that slip past shovel blade, is good for transplanting trees. Spade also cuts square-sided trenches, as for footings.

## Should the handle be long or short for greatest ease?

**LONG, STRAIGHT HANDLE** gives you more reach for stand-up shoveling without stooping or for getting down into pits and trenches. When hole is deep enough to stand in, switch to a short D-shaped handle. It lets you work in confined spaces, is easier to grip for tossing loads.

right side up. If it rolls over, upside down, it's likely to do the same in use. The effort to hold the blade upright under a load will strain your hands and lead to blisters.

***What length handle?*** The long handle is best for stand-up digging and scooping as it saves you stooping. It also gives you a longer reach for spreading topsoil and other materials.

The shorter D-handle is better where you want to toss loads with good accuracy. The crosspiece in the grip gives you something to push against at the start of the throw and something to haul back on when you "shoot" the load.

A D-handle is also a must for working in tight spots, as in a deep pit or trench. Only a little more than half the length of a long handle, it lets you grasp it easily at the end with one hand and just behind the blade with the other for good leverage and control.

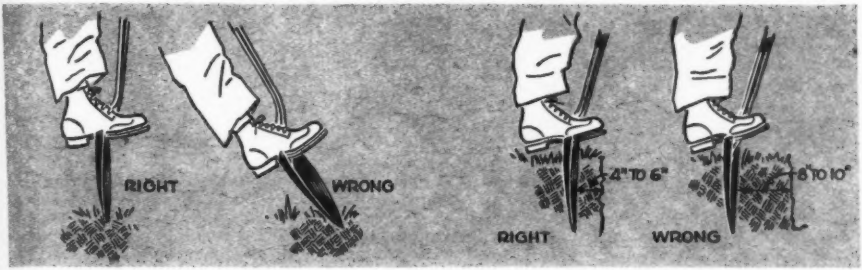
***Is it a shovel or spade?*** It's easy to mix these up, but they mean quite different things. A *shovel* is round-pointed and slightly concave. A *spade* is square-pointed and almost flat.

Just to confuse matters, however, there is such a thing as a square-pointed shovel and a round-pointed spade. But the rounded spade, made in the past, is now rare. The square shovel is still in use, but is really a scoop, not intended for digging. It slides easily on the ground and has high, curved-up sides to hold in mounds of loose materials. You see it used by coal men and by road crews scraping up sand and gravel.

The conventional square-pointed spade is the tool for gardening. In transplanting trees and shrubs, its straight edge cuts roots that would slide past the round-pointed shovel. In transferring sod, it makes neat, square cuts and lifts out the soil to an even depth. It's also handy for edging along walks and gardens and for digging small, flat-bottomed trenches.

The round-pointed shovel is the big earth-mover. Its sharp tip pierces the soil more easily than a spade, and its curved sides hold a larger load. In transplanting, you'll find it helpful to use a combination of the two: a spade for digging up a tree and a shovel for digging the new hole where the tree will go. If the foliage is low and thick, use a spade with a short D-handle to keep it from fouling

## How to dig fast without straining your muscles




**DRIVE THE BLADE STRAIGHT** into the ground so you can put your full weight on it. If the blade slants, you'll take a shallow cut and have to stoop way over to break the clod loose.

**TAKE SMALL BITES,** not more than 4" to 6" wide. You'll work faster and actually move more earth in a given time than when you try to heft large, heavy loads that tire you out.

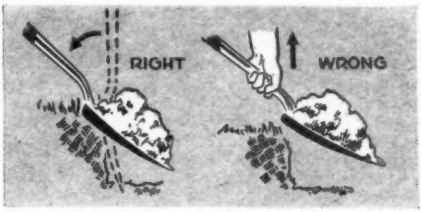
in the branches. If the branches don't get in the way, a long-handled spade will give you greater leverage for prying the tree out of the ground.

***Do blade sizes vary?*** Shovel blades are numbered according to their size, but, oddly enough, there's really only one size that's readily available. This is the No. 2, sometimes stamped on the blade or handle. In shovels, it means a blade 12" long and 9" wide. A No. 2 spade has the same 12" length, but is only 7" wide. These are generally the only sizes stocked by dealers.

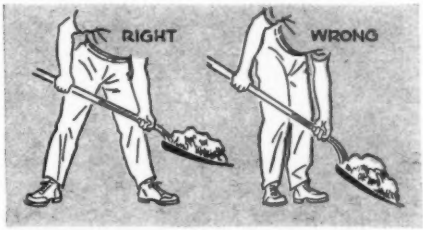
Occasionally, you'll find—or could order—a No. 1 shovel. This is slightly smaller than the No. 2—11¼" long by 8¼" wide—and is so little different that it's hardly worth fussing over. A No. 4 shovel—the only other size commonly made—has a long blade of 13" and is 9¾" wide. It's too big for general digging, but is sometimes used for faster shoveling of light materials, such as cinders, because it holds a lot.

***Special-purpose shovels*** come in several sizes, but are not numbered. A narrow 10"-by-7¾" blade is often called a "garden shovel." In its commonest form, it has a low-lift handle, like a trowel's, about 42" long. It's smaller and lighter than standard shovels and is easier to handle between plant rows.

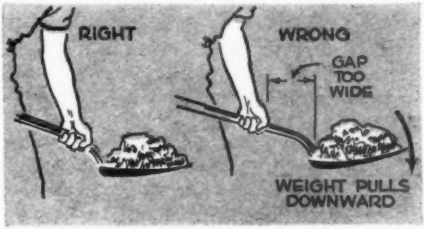
A still smaller blade, about 8" long and 5¾" wide, is known as a "floral shovel." It's easy to maneuver in tight places and ideal for transplanting without disturbing nearby flowers. Since these offbeat sizes vary somewhat from make to make, it's wise to check several




**DON'T LIFT STRAIGHT UP**—that's wasted effort. First rock the shovel back against the edge of the cut to raise the load and start it in motion. Lifting is then quicker and easier.



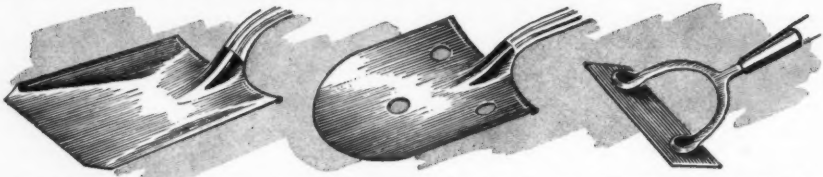

**KEEP FEET APART** and they'll add spring to the lift, taking strain off back and shoulder muscles. With feet close together, you tire quickly and are off balance when you toss a load.




**GRIP THE SHOVEL** close to the load and you'll get most lift with least effort. Otherwise, the load exerts a lever action, forcing you to waste extra energy to counterbalance it.

CONTINUED

### These first cousins to the shovel do many special jobs



**SQUARE-POINTED SHOVEL** is really a scoop, no good for digging. Its turned-up sides hold in loose materials such as sand, gravel, ashes, and coal.

**RICE SHOVEL** has holes in blade to drain water in clearing muck and silt from streams or gutters; name is from use in rice paddies.

**GARDEN SCUFFLE HOE** has two-edged blade set at sharp angle like a high-lift shovel. Back-and-forth motion shears off weeds and mulches the soil.

**TURF EDGER** looks like small, flat shovel. It has sharp blade and long handle for cutting trim edges along gardens and walks.

**SOD LIFTER** has small heart-shaped blade with long, deep-hang neck that lets it slice under sod squares without digging deep.

**ICE CHIPPER,** or sidewalk cleaner, has small, flat blade and straight handle. Slid along pavement, it strips off ice or mud.

**CONCRETE SPADE** looks like ice chipper, but has slight hang and lift. It's used to scrape and smooth concrete inside wood forms.

to find the shovel that suits you best.

***How to dig without strain.*** Professional diggers move 10 to 15 *tons* a day without fatigue because they know how to do it right. In turning over a home-size garden, you'll move two to three tons yourself—still a hefty job.

To avoid strain, drive your shovel straight into the ground. If it slants, you'll have to bend way down to pry out the clod. Once the blade is a few inches in the ground, don't be afraid to step up and put your full weight on it to complete the drive.

To break out the clod, pull back on the handle, letting the near edge of the soil act as a fulcrum. Grip the metal socket close to the blade with one hand and start lifting as the clod is levered free. If you grip the blade too far back, the load's weight actually makes leverage work against you, and you must strain to counterbalance it.

Take small bites, only 4″ to 6″ wide. In damp earth, this much will weigh about eight pounds and is easily lifted. Tests show you can actually handle greater yardage in a given time this way than with big bites, because you work faster without frequent stops to rest. A full 8″ to 10″ shovel load weighs up to 20 pounds, inviting quick fatigue and muscle aches.

With the proper touch, you'll find you can turn over a square yard of garden, shovel deep, in three to five minutes. You'll actually be moving about 250 pounds of earth—an eighth of a ton.

***Take it easy on snow.*** Those sudden attacks you read about that strike snow shovelers are the result of too much exertion at a time of year when you're out of shape to begin with. Some snow shovels have mammoth blades, apparently on theory that the bigger they are, the faster they'll get the job done. This is dangerous nonsense.

Choose a snow blade not over 16″ wide. This is ample for slicing a single path when you're in a hurry—you can widen it later. Remember, a 12″-by-16″ shovel, used in foot-deep snow, lifts about eight pounds each time—almost a quarter-ton on a 50′ walk, two tons on the same length of driveway.

If the snow is very deep, don't try to lift the full depth in one scoop. Slice off a top cut first, then the bottom layer in a second stroke. You'll last a lot longer. ■ ■

materials file

# The Types and Grades of Calking Compound

***Here's everything you'll want to know about the magic stuff that seals out wind and weather***

THE average house has 1,000 feet of cracks, gaps, and slits that need calking. That's a lot of potential leakage, and these bright autumn days are the ideal time to seal them; a tight house will mean lower fuel bills this winter.

Manufacturers of calking (some of them prefer to spell it with a useless "u") have increasingly angled their products to the do-it-yourself market. Not too long ago, calking was sold principally to painting contractors—in five-gallon cans. Today, it's the rare home owner who doesn't have his own arsenal of calking cartridges and guns. But few have all the facts about the stuff they're squeezing into their walls.

***What's it made of?*** Standard calking material is a compound of pigments, fibers, oils, and thinners, blended into a putty that develops a leathery, weatherproof skin once it's applied, yet remains plastic. The skin lets you paint over the calking, while the flexibility permits it to maintain a seal, even when the edges of the material it's stuck to shift or contract. And it sticks to anything: wood, metal, glass, or masonry.

***The colors.*** It comes in several shades of white, giving you some degree of choice for your job. Off-white is most widely used outdoors. If you want to match white siding without painting the calking, use a true white shade. Then

FOUR WAYS YOU CAN BUY IT
IN A CARTRIDGE FOR GUN USE
CALKING COMPOUND
IN A CAN FOR APPLICATION WITH KNIFE OR GUN
IN A SQUEEZE TUBE
IN THE FORM OF A ROPE

CONTINUED

**TWO TYPES OF CALKING GUNS** are half-barrel (left) which uses 1/10-gallon cartridge, and full-barrel combination gun (right) which can be loaded with cartridges or bulk compound.

**ROPE OR TAPE CALKING** comes in coils of various lengths up to 90', and consists of a ribbon of detachable strands. These ¼"-diameter beads are pressed into place like modeling clay. For larger cracks, reel off two at a time.

**TO PREVENT SEEPAGE** between siding and foundation wall, seal joints with knife-grade compound, applied with a putty knife or trowel. A little stiffer than gun grade, it will bridge large, irregular cracks with tenacity.

there's a "brilliant" white, which has—and keeps—the clean, groutlike appearance required for such indoor applications as around sink basins, tubs, and shower-stall bases.

Calking compound is also made in shades of gray, and in over 20 colors. If your dealer doesn't stock colored calking, buy bulk compound and color it yourself. A half-pint of coloring solution—pigment ground in oil—is about right for a gallon of compound. Pour the coloring on top of the calking (there's usually space under the lid), reseal the can, and have your paint dealer put it in his mechanical shaker for a couple of minutes to blend it.

***How's it packaged?*** Bulk calking comes in cans or drums ranging in size from a half-pint up to 55 gallons. It's offered in two grades: gun—for use in full-barrel guns—and knife, which is stiffer, and is applied with a putty knife. A gallon of good-quality compound costs from $3 to $5. If you're offered a bargain price, make sure you aren't getting inferior stuff; check to see that the brand meets government specifications.

Calking is also packaged in small quantities. Standard 8½" calking cartridges contain approximately 1/10 gallon, and cost from 50 cents up. They slip neatly into a half-barrel gun, to avoid messy filling. The gun may have its own tip or may require a tipped cartridge.

For the gun-shy, there are squeeze tubes at every dime store. You handle these much as you would a tube of toothpaste. Sometimes there's a roll-up key to squeeze the calking out evenly. Still another form of compound is rope calking. It's especially useful where a long, neat bead is a requirement, as in weatherstripping.

Two special types of compound are asphalt (reinforced with asbestos) and painter's calking. Asphalt calking is intended for rugged jobs like repairing roof leaks, spotting shingles, and sealing around flashings. Available in black or white, it costs around $6 a gallon.

Painter's calking is a high-quality compound for interior use. It's for filling cracks and holes along baseboards, around windows, and in other woodwork. Made only in white, it's ready for painting an hour after it's applied.

***General tips.*** Calking is ready for use as packaged, and should never be thinned. It should not be applied on damp days or when the temperature is below 40 degrees. A partly used can of calking will keep in perfect condition if you pour in water to cover the surface.

To estimate how much you'll need for an average-size crack, figure that a 1/10-gallon cartridge will fill 10 to 15 feet; a gallon can, about 100. ■■

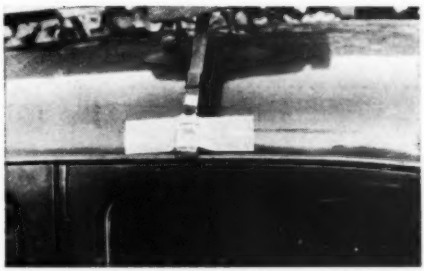
## Short Cuts and Tips
FROM PS READERS

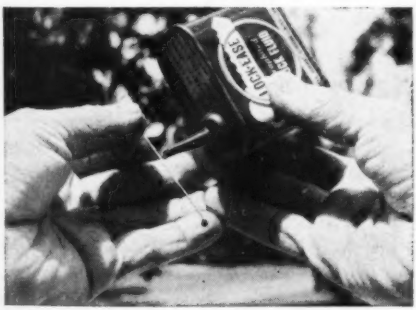
### Moving Target for Archery Practice

SHOOTING at a stationary bull's-eye doesn't prepare you for hunting deer and bear. You need a moving target about the size of the game animal's vital area. Cut a cardboard disk to fit inside the casing of an old tube-type bicycle tire. Have a friend roll it across your practice field.—*John Krill, North Lima, Ohio.*

### Tape Anchors Car-Top Carrier

RUGGED trips may call for extra measures to keep a car-top carrier from slipping to the rear. Aside from wind drag, abrupt dips or bumps momentarily reduce tension on the eave straps, permitting the hooks to hop back a fraction of an inch. I had this problem on a trip along the Alcan Highway until I applied masking tape over the hooks to anchor them.—*Harvey Versteeg, Inkster, Mich.*





### Oiling Hard-to-Reach Spots

FLOW oil where the oilcan won't reach by touching the spout tip to a clean piece of wire (a straightened paper clip does fine). Rest the end of the wire on the spot to be oiled, or let a drop form on the end and place it where it's needed. The trick is to keep both hands steady; it helps to press fingertips together, as shown.—*Bob Gilmore, Sonoma, Calif.*

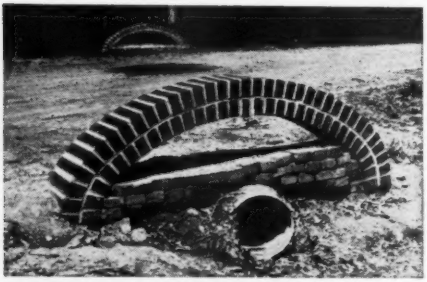
### Brand Wood with a Stencil

BURN your monogram on the woodworking projects you turn out. Make a stencil from .002" bronze shim stock or other thin sheet metal, cutting the lines about $\frac{1}{16}$" wide. Hold the stencil tightly against the work surface and rub the tip of an electric soldering gun across the openings until the exposed wood is charred.—*Walter E. Burton, Akron, Ohio.*

# How to remove this SAVE-IT SECTION

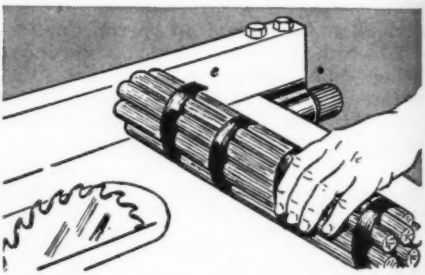
Here's another PS Save-It Section to add to your shop reference material. This one consists of 12 pages—three sheets, each folded in the middle.

To remove the section from the magazine, pinch the 12 pages together and carefully lift the end of the section that's toward you, pulling gently but steadily to free it from the first staple through the magazine. (This will rip a section from the fold, but you can cover this with tape.) Still lifting firmly, tear the section free from the second staple—and the magazine. Finally, to make your section a permanent addition to your shop reference material, staple it through the edges and, if desired, crease a strip of tape along this edge. Masking tape will do fine.



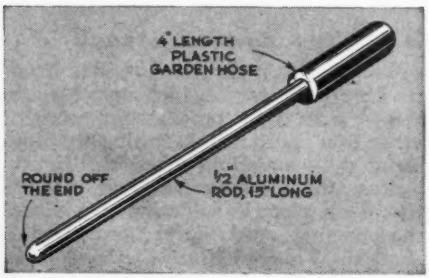
## Arches Protect Culverts

BRICK culvert arches, erected by Stanley Garbs in the vicinity of Okawville, Ill., have a double purpose: The arches pinpoint the pipe outlets, especially at night, and they also dress up the installation.—*Grover Brinkman, Okawville, Ill.*



## Bundle Dowels for Cutting

WHEN I need a number of dowels cut to the same length, I bind them into a tight bunch with masking tape, making sure they're all flush at one end. After a pass or two on the bench saw, I peel off the tape.—*Wayne H. Matthies, Buffalo, N.Y.*




## Homemade Hone for Knives

AFTER sharpening a blade on a flat stone or grinding wheel, you should try giving it a few strokes with an aluminum rod to get a really fine-honed edge. To make the rod easier to hold, slip on a handle of plastic hose with an inside diameter smaller than the rod. If you soak the hose in hot water a few minutes before forcing it on, it'll fit tightly when it cools.—*Jack Neill, Bellport, N.Y.*

Popular Science Monthly
SAVE-IT-SECTION

# Catalogue of Clutches and Transmissions

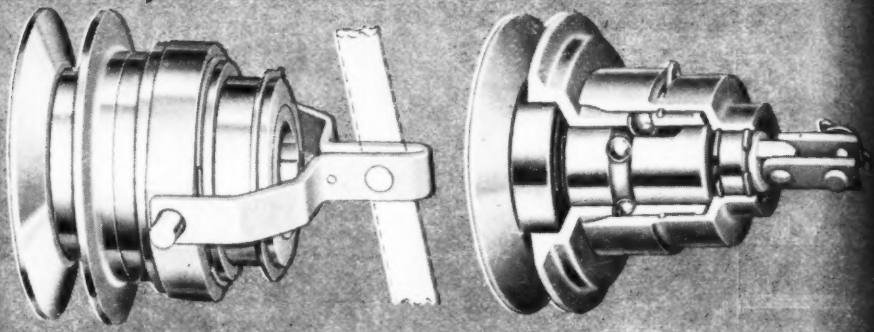
## FOR SMALL MACHINES

EVER since gas engines became sassy enough to run something besides themselves, we've needed better ways to apply their peculiar, pulsating power. The latest hardware includes a hydraulic clutch, a small planetary reversing transmission, and a gee-whiz drive that changes ratios by wiggling levers instead of shifting gears. Here's what you can get for powering scooters, midget cars, garden machinery, and tools:

- Clutches ranging from familiar cen-

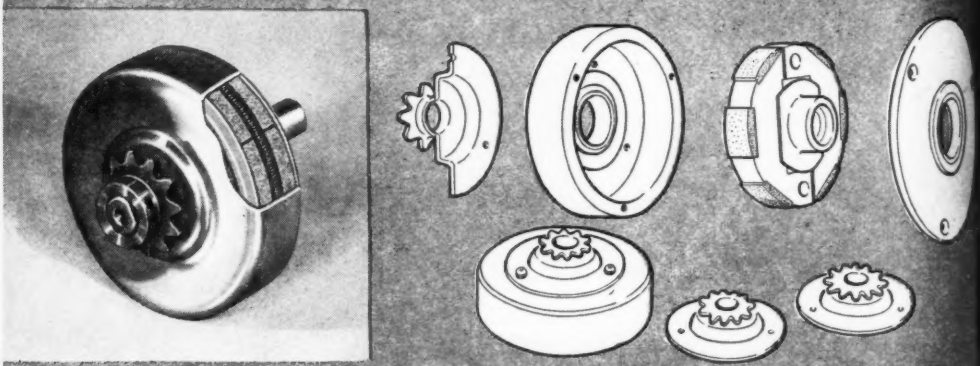
**A buyer's guide to all that's NEW...SURPRISING...CLEVER**

## Clutches may be hand-controlled or automatic

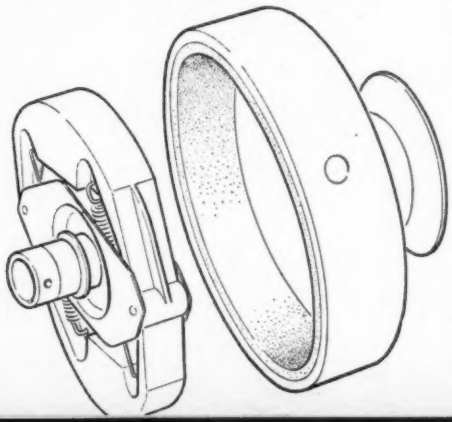


**WITH BALL-BEARING SMOOTHNESS,** one movable flange glides in to engage the belt in Ball-Lok manual clutches. Controlled by either a shift collar (above, left) or a ball-thrust bearing (right), they lock in driving position. Ball-thrust models can be had in nonlocking styles, the control lever requiring spring loading. These take up belt stretch.

**MADE FOR KARTING,** the Mercury clutch (below, left) has friction segments retained by a garter spring, and is designed to eliminate chain lash. Yoder clutch in drawing has two lined segments retained by springs in shear, comes with three easily interchanged sprockets.



**TWO SHOES PIVOT** on a balanced rotor in Salsbury's Centri-Dyne clutch. It has only nine parts. The pulley and housing are cast as one, with friction lining all around inside.

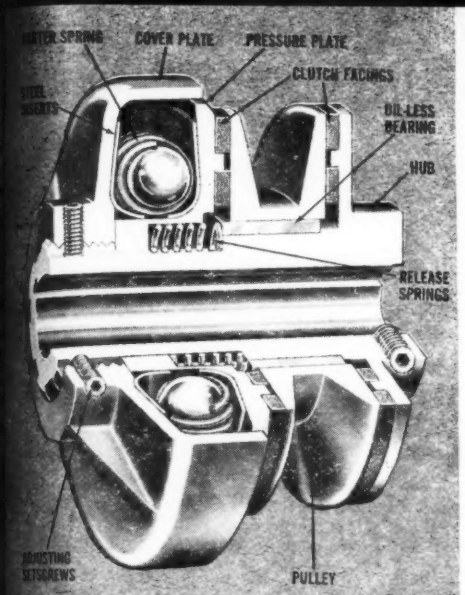


trifugal V-belt types to some with interchangeable sprockets; self-locking ones you engage by hand; and a group that become transmissions by changing the diameter the belt rides on.

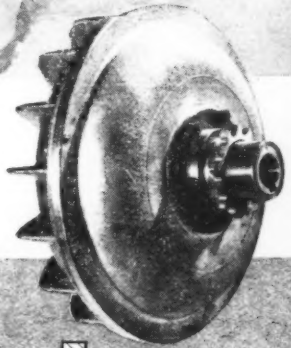
- Transmissions that deliver engine effort at the right revs (usually lower than the engine's) and with the needed torque or twisting force (generally more than at the engine shaft). Some transmissions shift for themselves, governed by the load's effect on the engine. Others you control manually. Some include reversing.

- Brakes—all too often a last-minute improvisation—designed to absorb all the momentum built up in a drive system. New ready-to-install units put sound en-

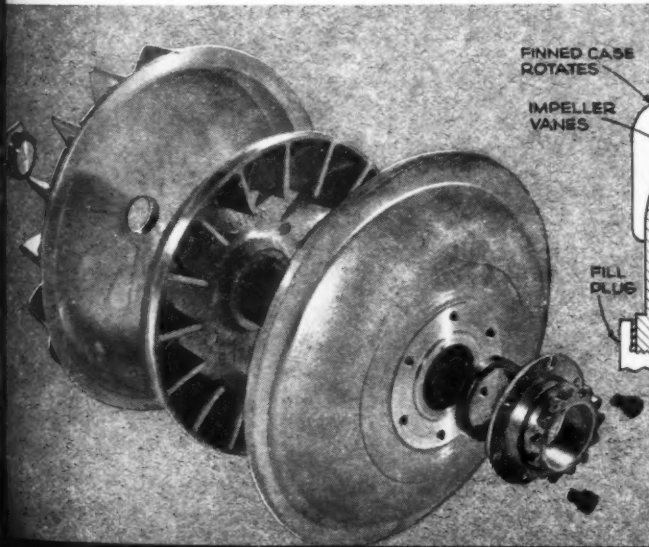
CONTINUED

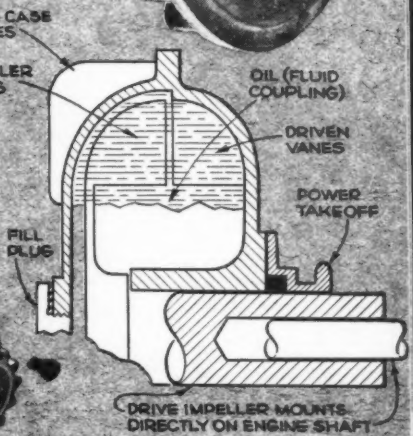


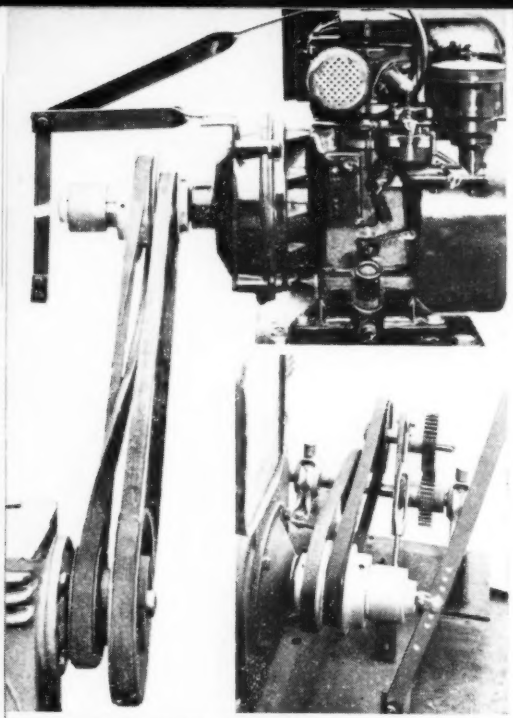

**THE BELT STAYS TAUT** on this Salsbury Gripmaster clutch. Expanded by centrifugal force, the garter spring wedges into a tapered insert, forcing a pressure plate to pinch friction facings against the sides of a solid pulley. When disengaged from friction facings, the pulley rides on an idler bearing.



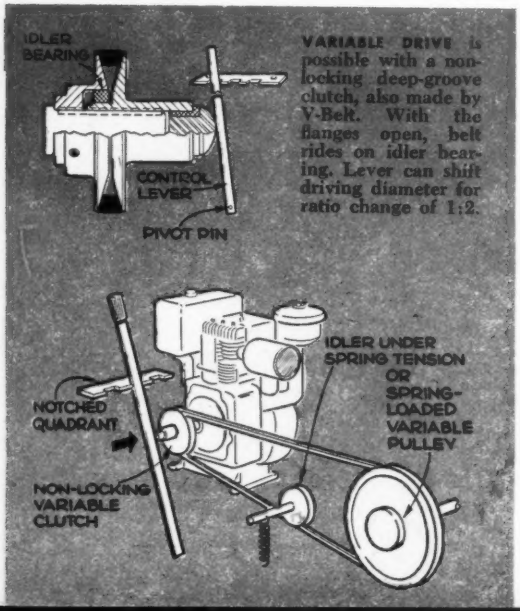
**EVERYTHING GOES 'ROUND** when the Bowlus hydraulic clutch is driving. Able to transmit two to seven horsepower, it weighs three pounds, has no wearing parts but an oil-impregnated idler bearing. The engine drives an impeller (between housing parts below). Oil sloshes about idly until the engine revs up. Centrifugal force then flings oil outward between impeller and driven vanes, turning the casing and sheave or sprocket bolted to it.







**SLICK TRICKS WITH DUAL CLUTCHES** include geared reverse (above, right). With left-hand sheave engaged, driven shaft turns forward. As right-hand sheave is engaged instead, its belt drives idler shaft, whose gear turns final shaft backwards. Gearless reverse (above, left) has one twisted belt. Dual clutches, made by V-Belt Clutch, have neutral position.


IDLER BEARING
CONTROL LEVER
PIVOT PIN
VARIABLE DRIVE is possible with a non-locking deep-groove clutch, also made by V-Belt. With the flanges open, belt rides on idler bearing. Lever can shift driving diameter for ratio change of 1:2.
NOTCHED QUADRANT
IDLER UNDER SPRING TENSION OR SPRING-LOADED VARIABLE PULLEY
NON-LOCKING VARIABLE CLUTCH

gineering on the job to give real stopping power.

***Clutches give the word*** to engage or disengage the driving power. They are of value even in electric-motor drives, easing electrical starting surges or enabling a smaller motor to do the work of a bigger one.

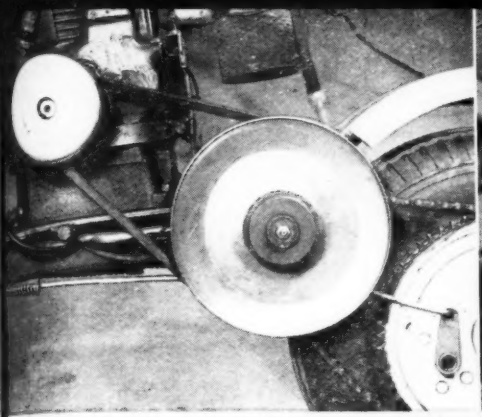
The simplest clutches use the V belt as the engaging element. One flange of the belt groove slides on the pulley hub. Internal weights fly out as engine speed climbs, and push this flange against the other to grip the belt. The engaging speed depends upon internal springs, and for electric drives is usually lower than for gas engines.

For control independent of engine speed, there are the Ball-Lok clutches made by V-Belt Clutch Co. They have a throw-out collar on a sliding flange that rides on steel balls and is locked by other steel balls. The collar can be fitted with a single-end control fork for use on the stub shaft of an engine or electric motor, or with a double-end fork that lets the shaft run through. You have to provide the pivot mount for the fork.

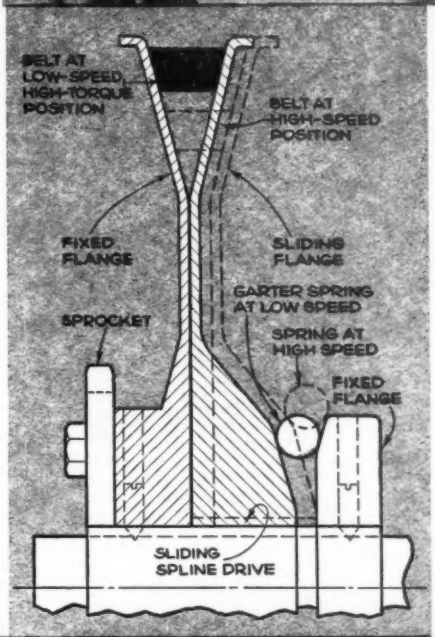
In the same line are nonlocking clutches, also engaging V belts by sliding a movable flange against a fixed one. But these must be held in engagement by 15-to-25-lb. pressure against a ball-thrust bearing. They too come in stub-shaft and through-shaft types, have very short actuating travel—only ¼″—and can be controlled by solenoid, air or hydraulic cylinder, or flexible cable. The control should be spring-loaded at engaging pressure.

***A V-belt clutch*** will carry about the same power as a plain pulley of its diameter running at the same speed. Mounted at the high-speed end of a power train (which means on the engine, in most cases) it will have a higher power rating than it would farther along in the train.

This is because the power a belt can transmit is dependent on its surface speed. If a V-belt clutch is put on a shaft running slower than 750 r.p.m., for example, it may take a heavier belt and clutch, or even a two-belt drive, to carry the same horsepower a smaller clutch and a single belt could handle at higher speed. (Ball-Lok clutches are made in two-belt types also.)



**THE SPRING SHIFTS** to give the V-Plex variable-drive pulley (drawing at right) more flange pressure at high-torque demand. The slope the garter spring climbs is the secret. With a variable-speed clutch on the engine, this pulley with attached sprocket becomes countershaft of a two-step drive, as shown on scooter above. It automatically and progressively changes the drive ratio by more than 2:1 to suit the load. Clutch, belt, and pulley cost about $30.




Engaging speed is affected, too. Most centrifugal clutches won't begin to engage under 1,500 r.p.m. Even the manual-control type is slower to engage at low shaft speeds; it may take one to three seconds for the belt to climb into fully engaged position.

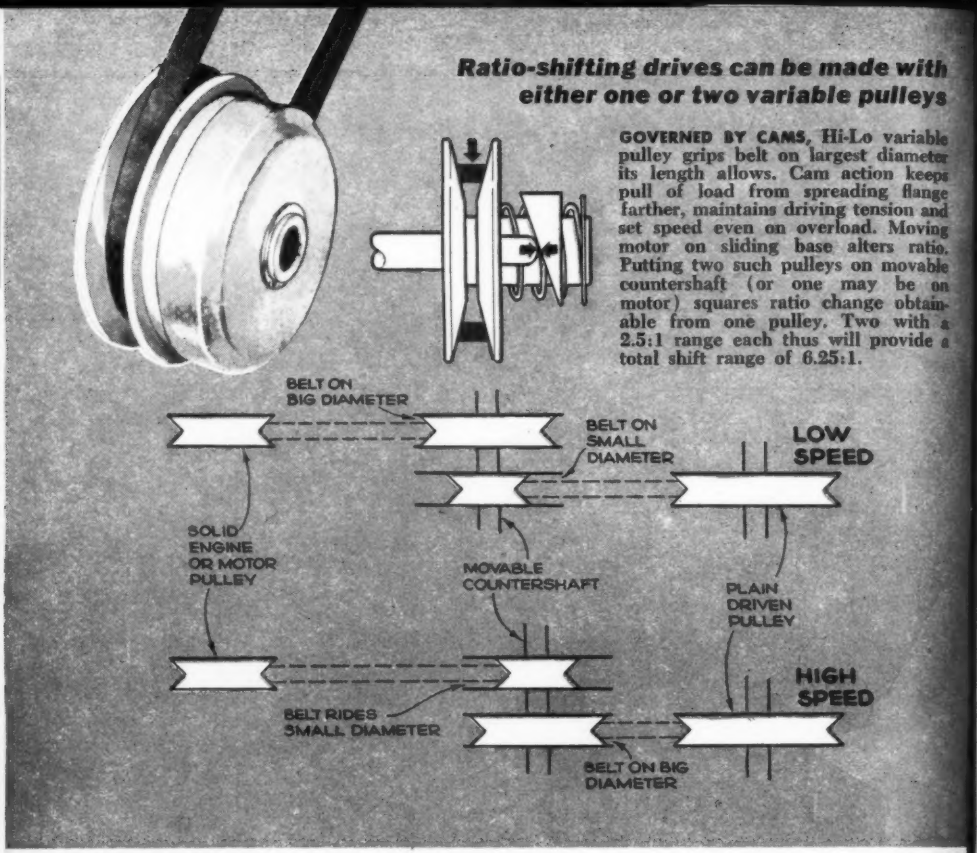
Self-contained clutches with the engaging elements inside can be had for V-belt or chain drive. One especially designed for midget cars is the Yoder. Keyed to the engine shaft is a flat-sided hub carrying two shoes with graphite-impregnated clutch segments on them. The housing and its cover plate have idler bearings in which the engine shaft turns when the

CONTINUED

## Clutch Summary

| Maker | Model | Price | Size (inches) | Hp. | Type | Remarks |
|---|---|---|---|---|---|---|
| BOWLUS | VB5/8 | $29.50 | 6½ dia. x 3¼ | 7 | oil | Works best on engines over 2 hp; comes with sprocket or pulley. Lightweight |
| FARM-EASY SERVICE | 4600 | $10.45 | 5½ dia. | 3 | cent. | Has pivoted shoes; engages at 1,000 r.p.m. |
| FAIRBANKS, MORSE | 35P51 | $14.95 | 3½ dia. x 2 | 3 | cent. | Engaging speed adjustable by changing springs |
| MERCURY | 41RC | $14.95 | 4¼ dia. x 2¼ | 4 | cent. | Plain or needle bearings |
| | GW-10 | $12.95 | 4 dia. x 2 | 2 | cent. | Has 12-tooth, ⅜-pitch sprocket; releases at 1,800 r.p.m. |
| MIDGET MOTORS | MD58 | $13.95 | 5½ dia. x 2¼ | 3½ | cent. | Lined shoes. All parts replaceable. For medium duty |
| V-BELT CLUTCH | J-11 | $12.50 | 2½ dia. x 4 | 2½ | man. | With end-thrust fork but without lever; Ball-Lok |
| V-PLEX | 18C5A2 | $ 5.95 | 3 dia. | 1½ | cent. | Has 2" A-belt pulley; all metal; engages at 1,800 r.p.m. |
| YODER | Kart | $19.95 | 4¼ dia. x 2½ | — | cent. | Includes quick-change 10-, 11-, and 12-tooth sprockets |

All the above act as clutch only. Most are available with ⅝" or ¾" shaft holes. Some makers offer similar clutches, differing chiefly in engagement speed, for use on electric motors instead of gas engines, and larger


Ratio-shifting drives can be made with either one or two variable pulleys
GOVERNED BY CAMS, Hi-Lo variable pulley grips belt on largest diameter its length allows. Cam action keeps pull of load from spreading flange farther, maintains driving tension and set speed even on overload. Moving motor on sliding base alters ratio. Putting two such pulleys on movable countershaft (or one may be on motor) squares ratio change obtainable from one pulley. Two with a 2.5:1 range each thus will provide a total shift range of 6.25:1.
BELT ON BIG DIAMETER
BELT ON SMALL DIAMETER
LOW SPEED
SOLID ENGINE OR MOTOR PULLEY
MOVABLE COUNTERSHAFT
PLAIN DRIVEN PULLEY
HIGH SPEED
BELT RIDES SMALL DIAMETER
BELT ON BIG DIAMETER

clutch is not engaged. Needle bearings are optional.

The sprocket is bolted to the cover plate, and the clutch comes with interchangeable 10-, 11-, and 12-tooth sprockets that can be switched quickly.

Similar is a clutch with a 12-tooth sprocket made for small cars by Mercury Clutch. Its engaging segments lie in a peripheral groove and are restrained by a circular or garter spring.

A true hydraulic clutch is made by Bowlus Engineering. Internal blading couples up as centrifugal forces act on the oil within. The housing has outside fins to dissipate heat. As there are neither weights nor linings, balance is excellent, the unit will run at high speeds without vibration, and nothing can wear but one bearing.

***Changing speed and torque*** to suit the load you're driving, whether it's a concrete mixer or a scooter, can sometimes be done with two or more straight V-belt drives. But they have only a fixed ratio; you can't "shift gears."

With any of several special devices, a V belt can act as a variable-ratio transmission. One such device is a dual clutch made by V-Belt Clutch Co. Its lever can engage either of two pulleys and has a center "off" position.

Belt the two pulleys to a common countershaft at different ratios, and you can select either ratio by a flip of the lever, or disengage power completely. Give one belt a half twist (for this, shaft centers should be at least 18" apart) and you can choose between neutral, forward, and reverse—the last at a different ratio from forward if you like.

The same company offers a variable-speed clutch. The belt rides on an idler bearing at the bottom of the groove when disengaged. A manually controlled sliding flange provides a range of driving di-

ameters. Detents are needed to hold the control lever at various ratio settings.

To keep the belt in driving tension as sheave diameter changes, the driven pulley should be of the spring-loaded variable type. This will automatically close up to push the belt onto a greater diameter as the driving pulley drops to a smaller one, and vice versa. Also feasible is a spring-tensioned idler.

***A high-ratio variable transmission*** can be made with two spring-loaded or automatic variable pulleys. Mount both on a countershaft positioned between engine and driven unit on a hinge or sliding block. The engine and final driven pulley are the plain kind. As you set the countershaft nearer the engine, the drive shifts to a higher ratio and lower speed. Moving the countershaft the other way makes the engine belt ride on a smaller diameter and the second belt drive from a larger one, stepping up speed. The countershaft must be locked in place.

Alternatively, you can put one variable pulley on the engine, a plain one on that countershaft end, and the second variable pulley on the other or driving end of the countershaft. It works the same way except that the countershaft must be adjusted oppositely, of course, for the same shift effect.

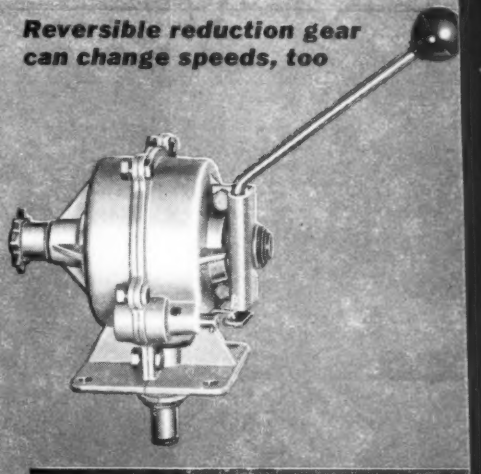
In either case, the total overall ratio range is found by multiplying that of both variable pulleys.

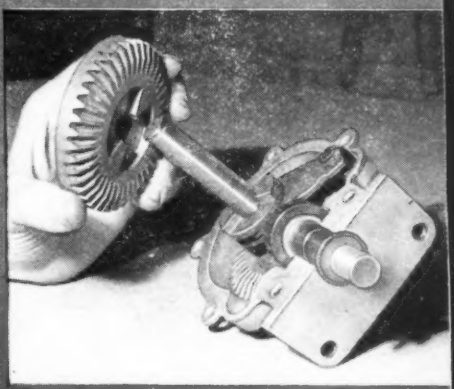
Another, and cheaper, variable pulley for such a compound drive is a two-groove unit whose free-sliding center member forms the inner flanges of both belt grooves. As this moves, it widens one groove and narrows the other. The relative diameters both belts ride on are determined entirely by the position of the countershaft.

The bigger they are, the costlier variable pulleys become. A large driven pulley made by V-Plex, used with a variable clutch, gives a ratio shift of more than 2:1 at reasonable cost.

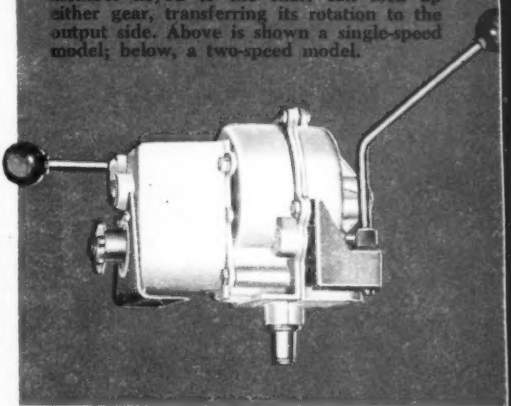
Spring loading of a movable pulley flange has the disadvantage that pressure is weakest when the belt rides the largest diameter—in "low gear" or maximum-torque position. The new V-Plex driven pulley reverses this with the arrangement shown on page 151. Judicious design of the spring groove gives a smooth shift with intermediate running positions. Two

***Reversible reduction gear can change speeds, too***



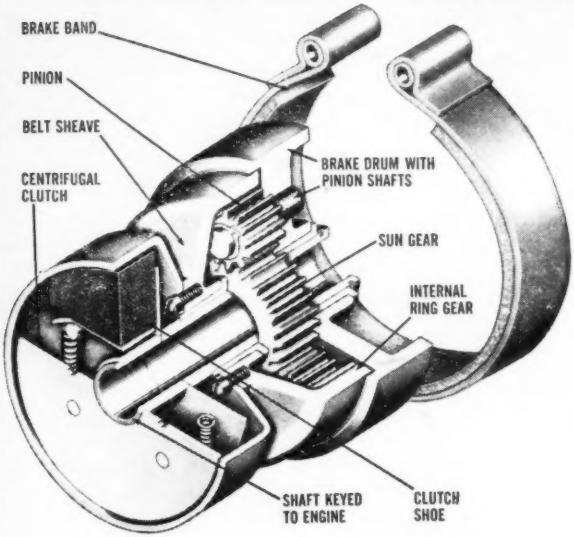


**BEVEL GEARS,** driven opposite ways by the input pinion, run free on the output shaft of this Foote reversing transmission. Sliding member keyed to the shaft can lock up either gear, transferring its rotation to the output side. Above is shown a single-speed model; below, a two-speed model.



CONTINUED

### *Throttle and brake control a reversing planetary transmission*




**REVVING UP THE ENGINE** engages the centrifugal clutch in Fairbanks-Morse transmission, turning belt sheave at engine speed. Three pinions and brake drum on which they are fixed also turn as one, but pinions do not rotate on their shafts. To reverse, engine is slowed below clutch-disengaging speed as sun gear keeps turning with engine. This makes pinions rotate inside ring gear, carrying brake drum around as the sheave stands still. As brake is applied, restraining swing of pinion shafts, pinion rotation transmits power to internal ring gear at 2:1 reduction in reverse, so turning the sheave backwards. Brake thus acts as a smooth reversing clutch, engine being held below clutch-engagement speed.

models of this drive, each including a variable clutch, belt, and variable driven pulley, will shortly be available at $30 and $40.

V-Plex also makes a line of variable clutches with drive cones deep enough to afford some ratio shift, and an unusual double one that, belted to separate drive wheels or countershafts on a vehicle, provides gearless differential action.

## Transmission Summary

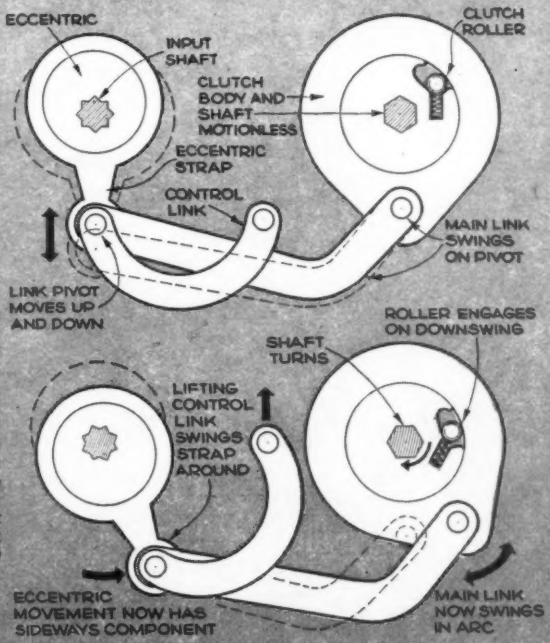
| Maker | Model | Price | Overall Size (inches) | Max. Hp. | Max. Input | Type* | Remarks |
|---|---|---|---|---|---|---|---|
| FAIRBANKS, MORSE | A625A | $34.95 | 4¹¹⁄₁₆ dia. x 4 | 5 | — | planetary RC | Engagement speed adjustable by changing springs; 2:1 reduct.on in reverse |
| J. K. FOOTE | P333 | $28.00 | 5½ x 6 x 6¼ | 5½ | — | gear R | 2⅝:1 reduction ratio; size is without lever |
| | P334 | $54.00 | 5½ x 6 x 8¼ | 5½ | 1,800 | gear R | Two-speed; low 3.4:1 ratio; high 2:1 ratio |
| FLINCHBAUGH | 1 | $29.00 | 6 x 7 x 18 | ½ | — | gear | Trade name Men-E-Uses; 7¼:1 reduction ratio |
| MACHINE ACCESSORIES | S1:2 | $25.00 | 2¼ x 4½ x 4¾ | ½ | 1,200 | gear | Trade name Gear-O-Mat; in ratios from 2:1 to 5:1 |
| SURPLUS** | Vickers | $52.50 | 6½ x 8 x 8½ | 2½ | 4,000 interm. | hydraulic RC | Stepless ratios from 3:1 up; max. 1,800 r.p.m. continuous |
| SURPLUS*** | Westing-house | $72.50 | 7½ x 7½ x 11½ | 1½ | 750 contin. | hydraulic RC | Trade name Oilgear; higher intermittent speeds possible |
| SURPLUS**** | — | $69.50 | 10½ x 21½ x 21½ | 1½ | 3,500 | hydraulic RC | Large and heavy but quiet |
| ZERO-MAX | 10E-400R | $65.00 | 3 x 3 x 5 | ½ | 2,000 | mech. C | Stepless reduction ratios from 4:1 and up; reversible unit available |
| SALSBURY | 400 ser. | $48.50 | depends on shaft centers | 2-5 | — | V-belt C | Idles at 1,500 r.p.m.; variable pulleys shift from 3:1 at start to 1:1 as load permits |

*R indicates unit provides reversing; C means it affords clutch effect, though it may not have an actual built-in clutch. Surplus** is available from Palley Supply and Airborne Sales; Surplus*** from Groban Supply and Airborne Sales; Surplus**** from Surplus Center and Palley Supply.

## *Link drive is stepless from zero to one-fourth input speed*

**GEARLESS TRANSMISSION** (the Zero-Max) uses eccentrics and linked levers to change drive ratios. Four or more eccentrics on the input shaft each have a strap on which a control link and a main link are pivoted. With control link down as at right, the eccentric pivot moves only vertically, at right angles to a line between input and output shafts. While input end of main link moves up and down, output end at right swings on the clutch body without moving it at all. Output shaft within clutch body does not turn.

**RAISING CONTROL LINK** draws the eccentric-strap pivot toward the horizontal. Its movement is now in part sideways, and displaces the clutch end of the main link through a short arc, so swinging the clutch body back and forth. Four rollers in wedge-shaped openings (only one is shown) engage to turn the shaft a short way on each clockwise swing but release on the backswing, ratchet fashion. Impulses of the four clutches overlap so that output movement is continuous. At 1,800 input r.p.m., there are 7,200 output impulses a minute.



***True gear transmissions*** are compact but may require a separate clutch. The simplest change the speed and torque in a single step. One is the Gear-O-Mat, available in two sizes and in ratios from 1:2 to 1:5 for either speedup or reduction.

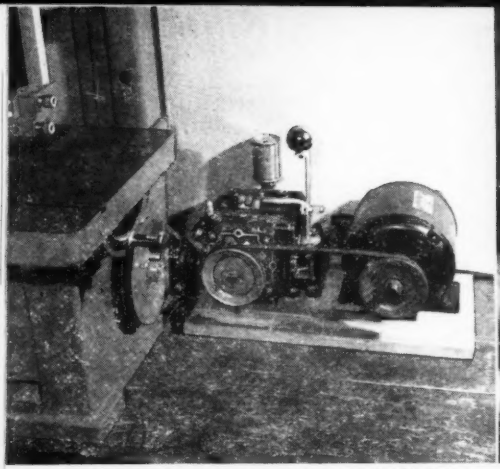
Another single-step gearbox justifies its name—Men-E-Uses. Both shafts are double-ended. Adjustable mounts, pulleys, and shaft couplers are supplied, the last acting as universal joints, so shaft alignment isn't critical. Like the Gear-O-Mat, this unit has a sealed gear case that keeps lubricant in and dirt out.

Reversing gear transmissions usually have a built-in reduction gear. In the Foote P-333, a lever shifts from forward to reverse by sliding a dog clutch keyed to the output shaft into engagement with one of two bevel gears. Both of these are in constant mesh with the input pinion and so turn in opposite directions, the output shaft taking its rotation from whichever is engaged by the sliding member. Reduction is 2 5/8:1.

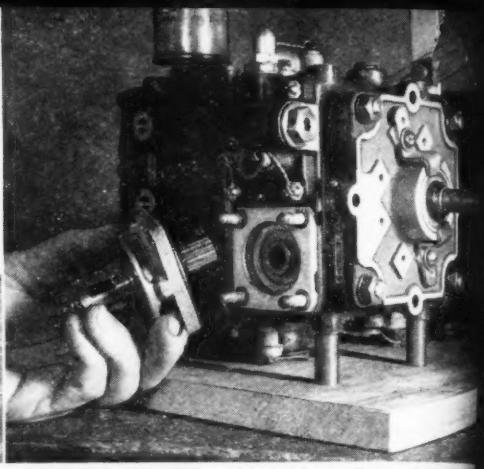
A two-speed version of this unit, the Foote P-334, has similar reversing parts but an extra housing containing a change gear. This gives overall ratios of 2:1 and 3.4:1. Separate levers control drive ratio and reverse.

Since the dog clutch is a rather brutal "go" or "no go" device, an external clutch should be used between engine and transmission. This could be a centrifugal type, though many small vehicles with these transmissions use a loose V belt and a tightening idler as a clutch.

CONTINUED



**SLICK WARTIME ENGINEERING,** embodied in a Vickers hydraulic transmission, shifts this bandsaw instantly from wood- to metal-cutting speed. A single lever controls output from a dead stop to a speed one-third that of the input and—though of no use in this application—can reverse it to the same degree.



**BUILT FOR BOMBERS,** the Vickers drive has splined sockets for input and output shafts. For V-belt or sprocket use, matching splined shafts with outboard bearings are needed. Big plate at right of case above was end plate of a drive motor made for this unit. Small plate held in hand was part of a B-17 turret drive.

A fistful of gears in a unit 4″ long and less than 5″ in diameter is the heart of a reversing transmission made by Fairbanks-Morse for 1½ to 5-hp. gas engines. It includes a centrifugal clutch, a 3½″ V-belt sheave for A or B belts, a planetary gear cluster, and a brake band that shifts the unit into reverse. Once past engaging speed, the pin-cage clutch develops a cam action that delivers full torque even at lower speeds. The greater the load, the lower the release speed of the clutch. For reverse, the engine must be slowed to disengage the clutch. The brake band is then applied, acting as a smooth-working clutch for reverse, which has a built-in reduction of 2:1.

***An amazing gearless unit*** has an action that seems curious at first glance, but is a very successful drive. The Zero-Max comes in sizes up to ¾ hp. at various torque ratings. From a single input speed, it provides stepless variable r.p.m. up to one fourth of that, with a constant boost in torque throughout the speed range. It can be shifted when running. As the control can drop output speed to zero, it acts as a clutch, too.

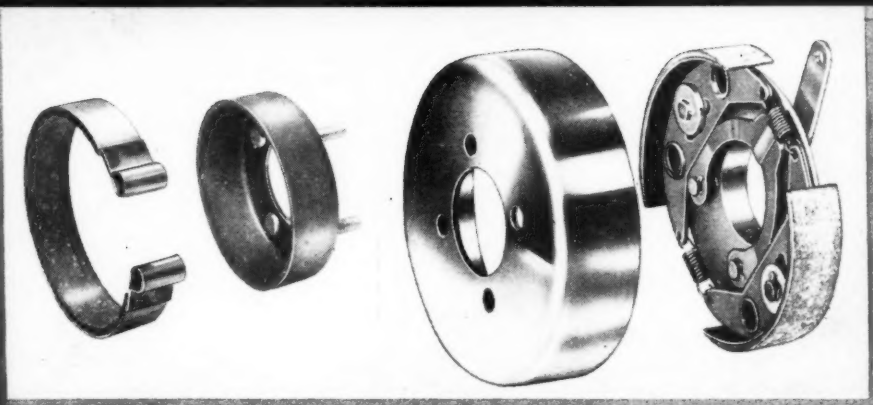
Although maximum input speed is 2,000 r.p.m., the 500-r.p.m. output can be stepped up (or down) by a suitable exterior belt, gear, or chain drive. Reverse is trickier, for changing input rotation does *not* reverse that of the output! Also, the peculiar operating geometry of the parts favors rotation in one direction. Therefore Zero-Max drives are designated for either clockwise or counterclockwise inputs. Reversible units have either two-way internal clutches or a gear reverse. Their output shafts can override, or free-wheel, in their drive direction.

Hydraulic transmissions, brought within the home mechanic's budget by war-surplus units, offer features no others can. Basically they consist of a multi-cylinder oil pump driven from the input shaft, a similar oil motor driving the output, and some way of varying the amount of oil circulating between them.

The Vickers drive has a seven-cylinder rotary oil pump, with valving for stepless control of the amount of oil it delivers from maximum to zero in one direction, and back to maximum in the other direction. It has a minimum reduction of 3:1 because the maximum pump output is .2 cu. in. per revolution of the input shaft, while the motor requires .6 cu. in. for a full revolution.

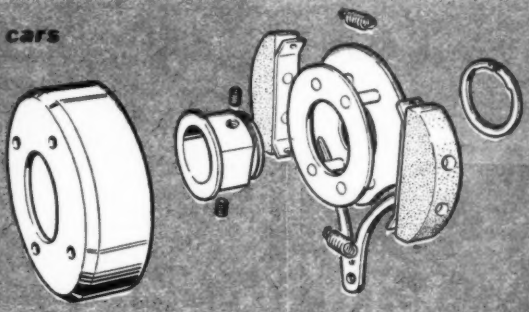
The single control varies output from one-third of input speed to zero. It can be moved with a finger, though internal oil pressures go to 1,200 p.s.i. because a booster piston supplies part of the controlling muscle. There is an extra gear pump to supply this booster and maintain the system's oil level.

The Vickers unit is only 6½″ by 8″



### *Small brakes like those on cars absorb momentum rapidly*

**LOW-COST EXTERNAL BRAKE** (top left) is offered by Mercury without actuating mechanism. Drum is bolted to wheel disk. Same maker's six-inch live-axle brake (top right) has all mechanism on backing plate. Fairbanks-Morse internal brake (right) is partly self-energized by cam action as torque causes shoe backings to ride up cage pins when brake is applied.



by 8½". Input speed may be up to 4,000 r.p.m. on intermittent duty. The drive's drawbacks: It is becoming scarce, is somewhat noisy in operation, and has only splined sockets for input and output shafts. For pulley drive, external bearings must be added.

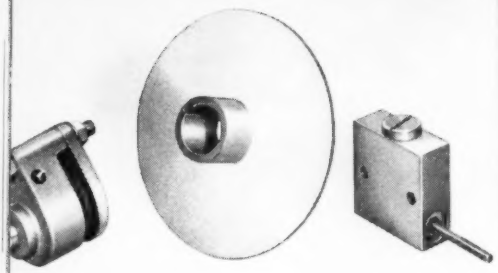
Similar though less versatile is the Westinghouse "Oilgear." It will handle about 1½ hp., but maximum continuous input speed is only 700 r.p.m. The output can be varied over a stepless range to the same maximum, and is reversed by a separate lever.

## Brake Summary

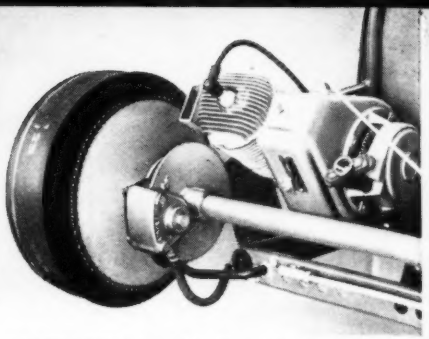
| Maker | Model | Price | Drum Dia. & Width (inches) | Type | Remarks |
|---|---|---|---|---|---|
| AIRHEART | Kart | $29.95 | 6 x ⅛ disk | disk and spots, hydraulic | Price is for single brake; installation kit $6.95 extra |
| BENDIX | 311267<br>311515 | $15.75<br>$ 3.75 | 6 x 1¾ | internal exp. | Part numbers and prices are for separate brake and drum |
| FAIRBANKS, MORSE | 70B2 | $ 9.95 | 3 11/16 x ⅜ | internal exp. | This unit uses clutch shoes; larger ones do not |
| | GB12 | $ 9.95 | 4¼ x 1 3/32 | internal exp. | For use on vehicles with engines up to 2½ hp. |
| MERCURY | 609LAB | $14.95 | 6 | internal exp. | Live axle brake |
| | 401SB | $ 4.50 | 4¼ x 1 3/32 | external contr. | Price is for lined band and drum; no operating mechanism |

All prices are for single brake only, smallest or lowest-cost unit in each type or line.

CONTINUED



**IN THE VANGUARD** on small-brake development is Airheart Product's sleek hydraulic disk brake. The part shown above at left is the brake cylinder. The master cylinder is at right.



**BRAKE DISK** is keyed to live axle. Spot linings in the brake-cylinder unit apply clamplike pressure from both sides. This part is connected to the master cylinder with flexible tubing.

Both the 16-lb. Vickers and the 21½-lb. Oilgear are light enough for use on small vehicles. A larger, heavyweight hydraulic drive (250 lb. with motor) is available in surplus stocks. Dealers rate it at from ⅝ to 1½ hp. Maximum input speed is 3,500 r.p.m.

Though too massive for vehicles, this might find use in machine-tool and other stationary jobs. It is said to run quietly. Surplus dealers also offer hydraulic motors, pumps, and valves with which you may be able to assemble a drive system to your own specs.

***To come to a stop*** in a midget car or riding mower, efficient small brakes are better than dragging your feet. And they're applicable to nonvehicular machines as well. You can buy external contracting or internal expanding types. The latter offer better protection from dirt and moisture, and are more compact. But they cost more.

Brakes are usually sold as single-wheel units: a drum (drilled for standard shafts, or with specified bolt holes, or undrilled) with a back plate on which the operating mechanism is mounted, and a lever to which the brake rod must be attached.

A real hydraulic brake in miniature is made by Airheart Products. It comprises a small master cylinder to link to the brake pedal, a steel disk to be keyed to the shaft, and a slotted assembly that straddles the disk. In this is the brake cylinder with its piston. Spot linings, which are replaceable, clamp the disk from both sides when the master cylinder is actuated.

As in automobiles, the hydraulic type insures equal pressure on two or more wheels. Also, the makers claim, it never requires adjustment, is subject to neither fading nor drag, and works with constant pedal pressure throughout the life of the spots. ■■

### *For more information . . .*

Questions on devices shown, or on those of different ratings, shaft bores, or ratios, should be directed to the manufacturers listed below:

- Airborne Sales Co., Inc., 8501 Stellar Dr., Culver City, Calif.
- Airheart Products, Inc., 15540 Lanark St., Van Nuys, Calif.
- Bowlus Engineering Co., Box 515, Pacoima, Calif.
- Direct System Corp., 62 Gill St., Buffalo 22, N. Y. (Surplus)
- Fairbanks, Morse, Beloit, Wis.
- Farm Easy Service, Muncie, Ind.
- Flinchbaugh Co., York, Pa.
- J. B. Foote Foundry Co., Box 2214, Ft. Dearborn Sta., Dearborn, Mich.
- Groban Supply Co., 1139 S. Wabash Ave., Chicago 5.
- Hi-Lo Mfg. Co., 4949 W. Lake St., Chicago 44.
- Machine Accessories, Inc., 2845 Harriet Ave. So., Minneapolis 8.
- Mercury Clutch Div., 1201 Camden Ave. S.W., Canton 6, Ohio.
- Midget Motors Corp., 76 S. Shannon St., Athens, Ohio.
- Palley Supply Co., 2263 E. Vernon Ave., Los Angeles 58.
- Salsbury Corp., 1161 E. Florence Ave., Los Angeles 1.
- Surplus Center, 900 W. O St., Lincoln, Nebr.
- V-Belt Clutch Co., 418 N. Western Ave., Los Angeles 4.
- V-Plex Clutch Corp., Hagerstown, Ind.
- Yoder Clutch Corp., Orrville, O.
- Zero-Max Co., 2845 Harriet Ave. S., Minneapolis 8.

s in
res-
to

ver
her
ant
the

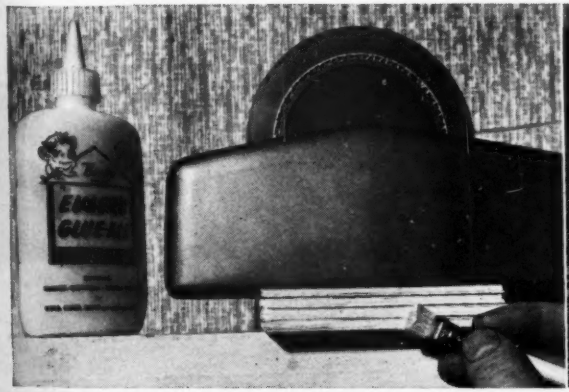
**CUT PAPER AND CARDBOARD** to desired dimensions and arrange in neat piles. Typing bond, quartered, makes handy-size pads.

## Short Cuts and Tips

FROM PS READERS

### Cut and Paste Your Own Memo Pads

ONCE you've got the memo habit, it's hard to keep the shop stocked with pads. If you have access to a paper cutter, you can make your own—in any quantity and size you wish. Trim paper scraps, or slice up new sheets. Shirt cardboard makes a good backing. Use any glue that's suitable for porous surfaces, and be sure to cover the edge thoroughly.—*Wayne Floyd, Fayetteville, Tenn.*

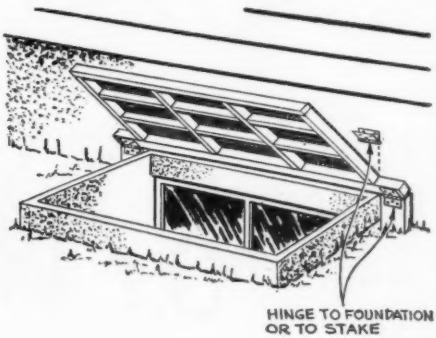


**BRUSH GLUE ON** one edge of a weighted stack of several pads projecting beyond table end.

**TO TEST GLUE COAT,** separate pads when dry, and lift each one slowly by its top sheet.

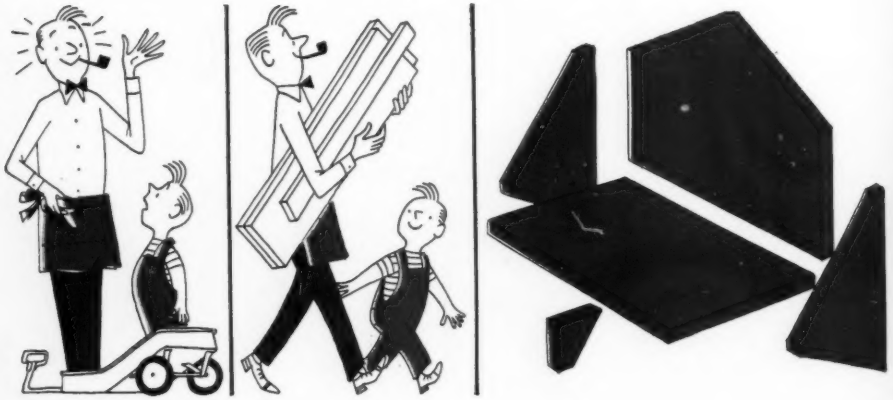
### Covers for Window Wells

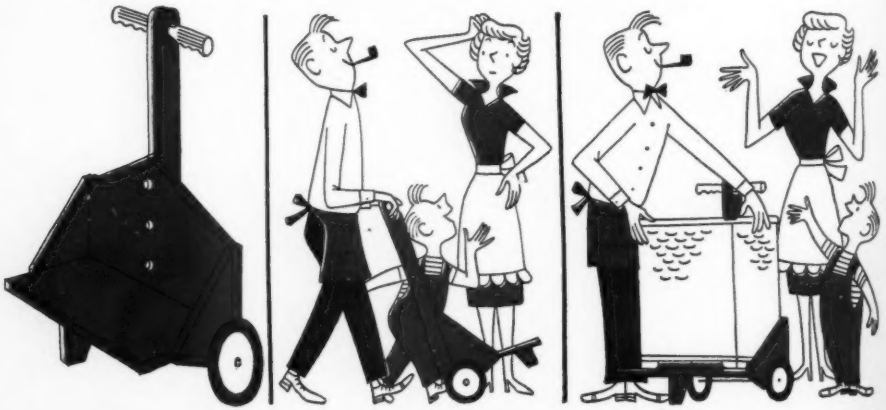
BASEMENT window wells can be both a hazard and a nuisance. Children dashing around the house can tumble in; leaves and other debris collect here, often causing wooden window frames to rot. You can make effective covers by nailing together a grid of one-by-one pine, to match the size and shape of the wells. Staple hardware cloth to this frame, and hinge to the foundation with masonry nails or lead anchors. Or you can drive wooden stakes close to the wall for this purpose.—*Jackson Hand, Westport, Conn.*

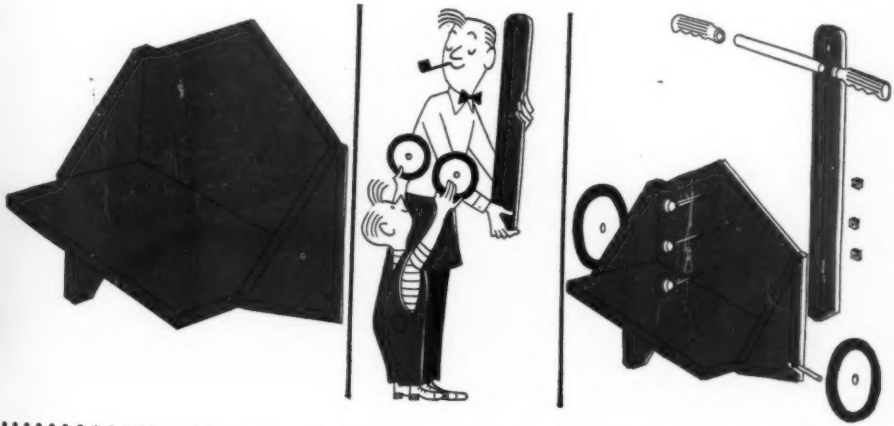


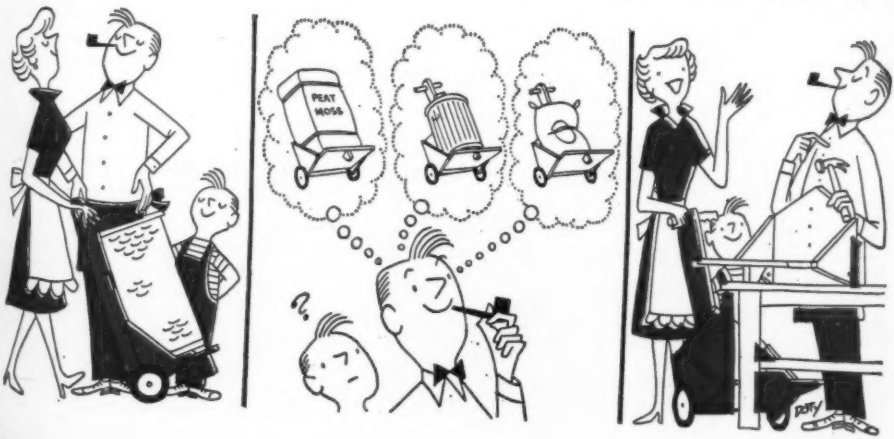
# Wordless Workshop

*By Roy Doty and John Mihalick*








PEAT
MOSS

## SHOP-USE REPORT on

# The New Atlas-Clausing 15" Drill Press

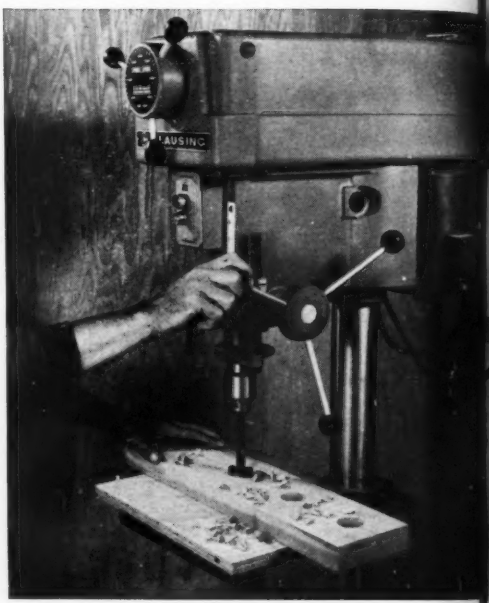
**By R. J. De Cristoforo**

THE drill press is one of the few power tools that is equally at home working metal or wood. Many experts say it'll do more jobs than any other tool you can own. But its speed range has generally been limited to the four steps on the drive pulleys—and switching the belt by hand from step to step is an inconvenience that often results in pinched fingers.

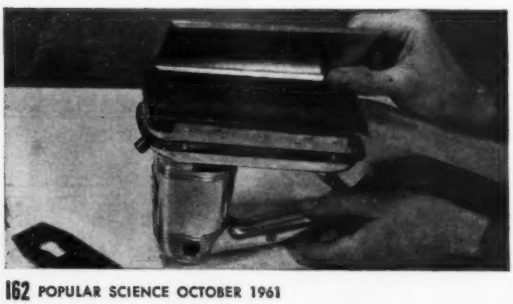
On the new Atlas-Clausing 15" drill press, you simply turn a dial for instant change-over to *any* speed between 500 and 4,500 r.p.m. while the machine is running. Your fingers never touch the belt. A pointer indicates the speed on the dial, eliminating guesswork or the need to check speed charts.

The whisper-quiet operation of the machine is impressive and unusual. Hardened steel balls under spring tension take up lash between the spindle and drive sleeve to eliminate completely the vibration noise common at high speeds. Extra mass in the castings adds to the rigidity and smooth operation of the tool, and eliminates chatter under heavy loads.

The ½" Jacobs chuck—which will close down to grip a No. 70 drill—is locked on the spindle with a threaded collar. This permits the safe use of routers, shaper bits, and rotary planers in the chuck, instead of switching to a spindle sleeve.

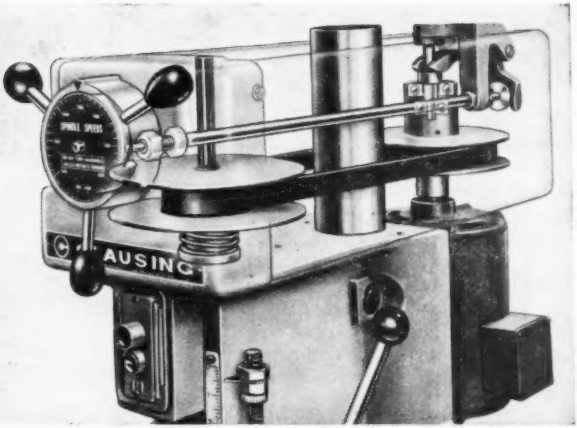


The Clausing Division of the Atlas Press Co., Kalamazoo, Mich., sells the bench model for $210. A long-column floor model costs $220.

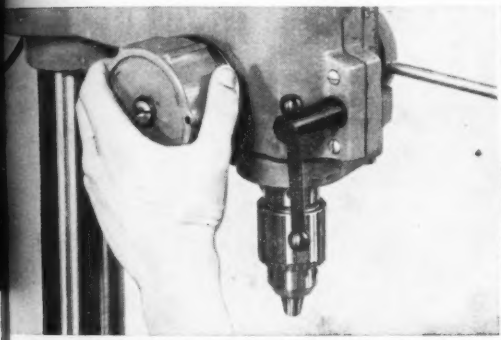


### Sander Sharpens Tools

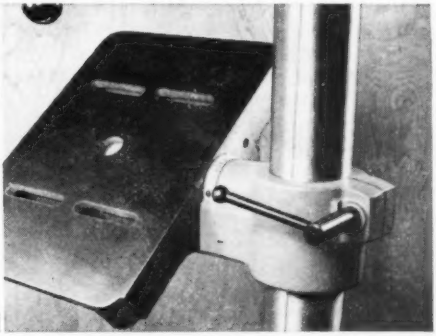
YOUR cutting tools can be sharpened quickly with a portable sander. Hold the sander upside down on the bench and press the blade lightly against the abrasive. Aluminum-oxide paper is best for the job. Back up the paper with a thin metal plate bent over the soft platen.—*H. Hanscom, Elmhurst, Ill.*




**TURNING THE DIAL** rotates a cam against a pushrod that actuates a smooth-working, variable-speed drive. The pushrod varies the gap between the two tapered halves of the motor pulley, in effect changing its diameter. The resulting increase (or decrease) in belt tension causes the spring-loaded halves of the spindle pulley to separate or come together, thus changing the spindle speed. Accessory variable-speed drives are not new, but this is the first time such a drive has been built into a machine and calibrated accurately.



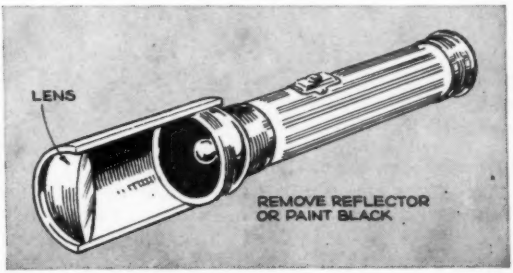
**BEEFED-UP SPINDLE RETURN** has 1"-wide clock-steel spring inside a cast-aluminum cap. By rotating the cap, the spring can be adjusted for light tension for delicate drilling with tiny drills, or for the husky pull needed to withdraw large drills from deep holes.



**GRADUATED SCALE** indicates the degree of table tilt in both directions. An indexing pin locates the table accurately at level, 45-, and 90-degree positions. The surface and front edge of the table are finish-ground while locked on a master column to insure alignment.

## Pointer for Slides

WHEN showing slides, you can indicate points of interest with this electric pointer made from a flashlight. Cement a cheap magnifier lens in a cardboard tube that fits over the flashlight. Slide the tube back and forth to focus a spot of light on the screen.—*L. S. McCready, West Redding, Conn.*



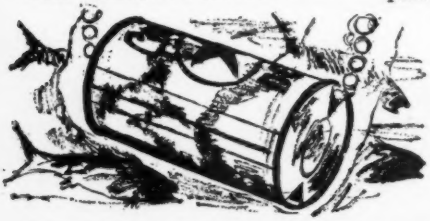
# Boating Hints

**An Ill Wind.** Check the wind direction if your motor conks out. A good breeze coming in over the water could nudge your boat close to the shore and safety, but a breeze from the shore will carry you out to sea unless you drop anchor at once to hold your position.

**Exhaust Fumes.** Remember to provide plenty of ventilation when running an outboard motor in a tank or drum filled with water. Exhaust gases are the same as those from a car engine, and they're just as deadly in a closed garage or basement.

**Fishing Pockets.** One fisherman who insists on having lots of things within hand's reach always wears a carpenter's apron. The pockets hold all his needs.

**Armrest.** During long sessions with a fishing pole, an armrest on your boat will make the waiting more comfortable. Remove one from a junked car and bolt it to the end of a foot-long board. Before the day's fishing, fasten the board to the gunwale at the right height with a pair of C clamps.



**Dunk Those Cans.** Cans left from food or refreshment should be punctured at *both* ends so they'll sink immediately when tossed overboard in deep water. Floating cans are unsightly and a hazard.

**Custom Sinkers.** You'll never lack for a sinker if you carry a roll of solid wire solder in your tackle box. Cut off the length needed to make the weight you need, and wind it around the line.

# Now...Cast Your Own 'Marble'

***Just swirl graining color through a batter of polyester resin. An old door or window frame serves as your mold***

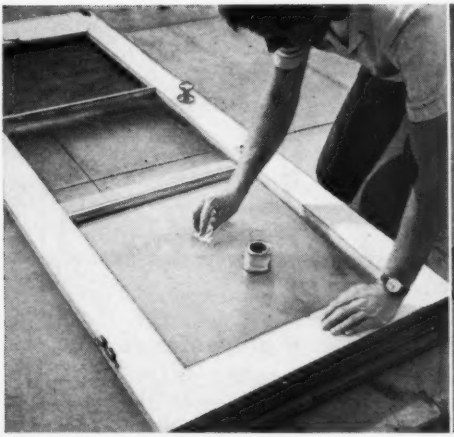
**By V. Lee Oertle**

A NEW use for polyester resin (of the boat-surfacing type) opens up exciting possibilities. When mixed with a cheap filler, this resin can be cast into a smooth slab. Swirl in a little color pigment before the resin sets up, and you've created a surface with the look of expensive marble, the feel of glass, and the durability of solid plastic.

When casting resin, you add a filler for economy; it beefs up the volume so you can save on resin. The choice of filler

CONTINUED 165

***You cast your slab upside-down in a waxed mold, pouring in***



**OLD DOOR OR WINDOW FRAME** makes good glass-bottomed mold for smooth slab. To increase depth, tack wood strips around edge. Rub paste wax on all surfaces resin will touch.

**CATALYZE THE RESIN** in a clean container and —after adding the base-color pigment (white bottle at right)—stir in filler (talc, here) a little at a time until the batter is creamy.

depends on the color and texture you want. For a glass-smooth finish and a white base coat, raw talc is ideal. It's an unscented version of the common cosmetic, and costs three cents a pound.

Other choices: iron oxide for a red tint, sand for a gray one. Silica, magnesium sulfate, calcium carbonate, slag, and crushed roofing rock may also be used. Sand provides a grainy surface, roofing rock a rougher one.

How much filler you need is determined by how thick a pour you like to work with. One resin manufacturer recommends a mix of no less than 30 percent resin to assure saturation of the filler. For the table in the accompanying photos, I mixed talc and resin about half-and-half by weight. My ¾"-thick, 21"-square slab took a little over a gallon of resin, about seven quarts of dry talc, and five ounces of pigment. (Slabs thinner than ¾" aren't recommended.)

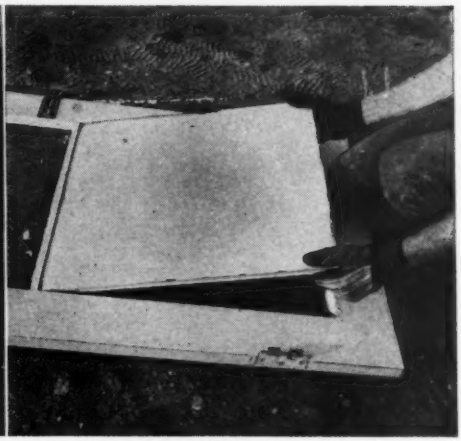
***Where to buy resin.*** Although ordinary boat resin will do, I used a special type; it's number 32-737 polyester, made by Reichhold Chemicals, Inc., and available from Wyndham Chemical, 13014 Los Neitos Road, Sante Fe Springs, Calif., or B & B Distributing Co., 250 W. 24 St., Hialeah, Fla. Or, you can write Reichhold at 525 N. Broadway, White Plains, N.Y., for a local source. The resin retails for about $4.50 a gallon, if you can find a supplier who will tap a drum. Resins are usually more expensive when packaged in gallon cans.

**TRIM EDGES STRAIGHT** and round corners, using metal-cutting blades in a saber saw for smooth cut. Polishing of edges is done by wet-sanding with No. 500 paper. Top needs no polish.

You'll also need a small container, marked off in cubic centimeters, for adding the catalyst, plus a two-gallon con-

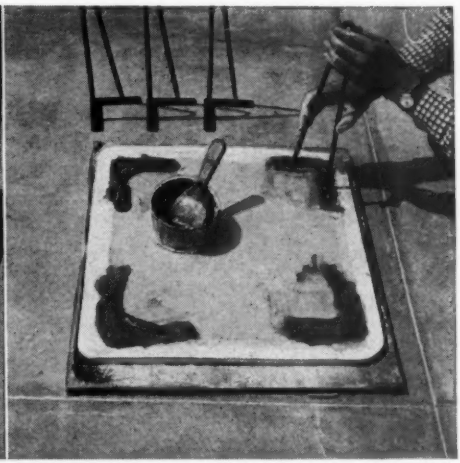
***catalyzed resin, filler, and graining color. It makes a fine table***

**BEFORE POURING INTO MOLD,** add a few ounces of the grain-color pigment and stir with two or three strokes, to leave it in swirls. Shim frame level so the resin flows to an even depth.



**LIFT SLAB FROM MOLD,** after it has cured for 24 hours. Shrinkage makes removal easy, but if it sticks use a putty knife along the edges. Flip the slab over to check grain effect.

**SQUARE OF FIBER-GLASS CLOTH,** cut 2" smaller than slab, is bonded to bottom with catalyzed resin after surface is roughened with sandpaper. This reinforces against sag or impact.



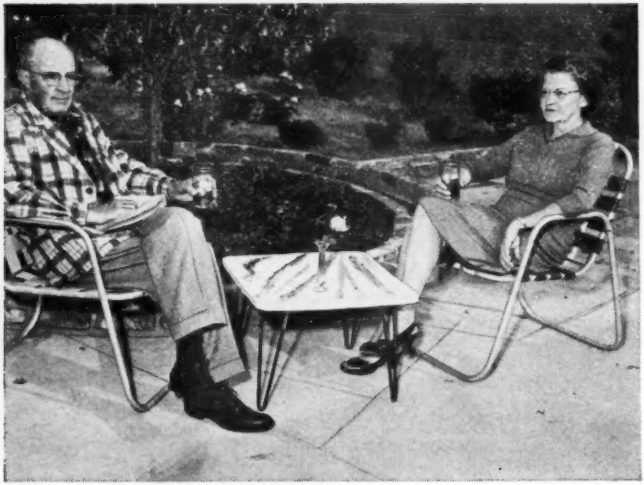
**PRESS LEG BRACKETS** into a putty made by adding filler to catalyzed resin. Then spread more putty over bracket until it's embedded. Sand any paint from brackets before attaching.

tainer for mixing. A polyethylene wastebasket makes cleanup easy: When the resin residue hardens, you pop it loose by squeezing the sides. Use acetone to clean your hands and tools.

Do your casting in a well-ventilated, shaded place—and don't smoke. Liquid polyester is inflammable, and gives off fumes. (Once it cures, this is no longer true.) Don't try to mix more than half a gallon at a time. To achieve the proper depth, pour consecutive batches into the mold. Be sure to add the same amount of filler and pigment to each batch.

***How to catalyze.*** Directions come with the resin. They usually call for 10 cc. of

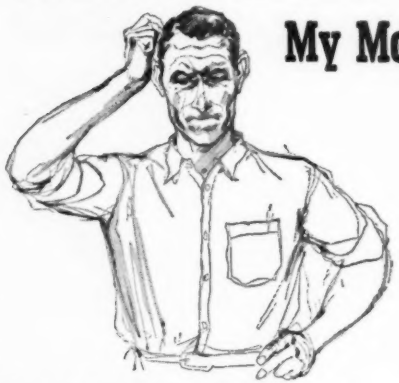
CONTINUED



**SLICK-SURFACED SLAB** makes an ideal patio table. It is nonporous, won't be affected by rain or spills—and the grain color resists fading. The slab has the heft of marble as well as the look; a sudden breeze can't tip over the refreshments.

catalyst per quart. By cutting this down to 7 cc., you can extend the working time before gelling begins. The *pigments* must be catalyzed separately, before you mix them into the resin.

You can add color after pouring, if the grain pattern seems thin. Just drip catalyzed pigment over the surface and brush it through to the bottom of the mold. The strokes you use are important. Short "S" strokes or long, wavy ones are best. The variations of grain design, color (green, brown, yellow, blue, red—or combinations), and surface texture are what give your table its distinctive, personal character. ■■



# My Most Embarrassing Shop Moment

**By Andrew M. Starr**
*Hermosa Beach, Calif.*

WHEN our new garbage-disposal unit arrived, I decided to impress my wife and hook it up myself. I did the plumbing work one evening and tackled the wiring the next night. I connected the machine to a nearby line, gave it a trial spin, and beamed when it worked beautifully.

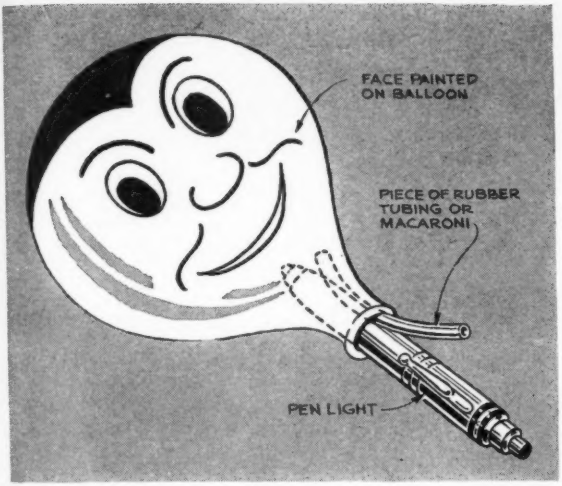
The following day, my wife phoned me at the office and said the disposer wouldn't work. When I got home, however, it ran fine for me, and I proceeded to lecture her on the stupidity of people who can't operate a simple machine like a garbage disposer.

Another day, and my wife called again with the same story about the nonfunctioning disposer. That night, I flipped it on and it again purred sweetly.

I was just about to launch into another lecture when it suddenly dawned on me that the lights were on at night whenever I worked the machine but not in daytime when my wife tried it.

Reluctantly, I switched off the lights and, sure enough, the disposer ground to a halt. I had wired it into the kitchen-light circuit so it operated only when the lights were on.

I'm still apologizing to my wife about stupid people who can't run a simple garbage disposer.




## Short Cuts and Tips
FROM PS READERS

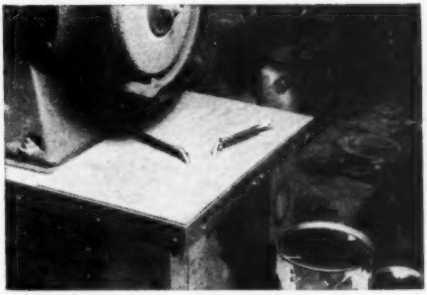
### Lighted Balloon Face for Halloween

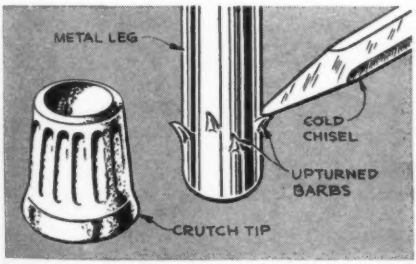
YOU'LL shed light on those eerie processions of trick-or-treaters by teaching your kids this stunt:

Stretch the mouth of a balloon over a pen light. Insert a tube (or piece of macaroni) to inflate it, and pull the tube out quickly. Paint a face on the balloon and flick the switch.—*D. O. Van Gilder, Denver.*

### Put an Edge on Can Openers

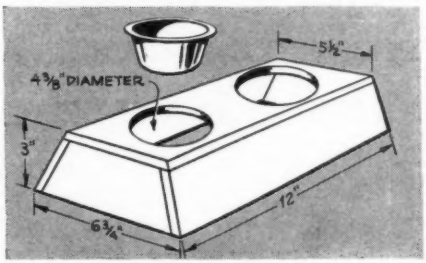
PUNCTURE-TYPE can openers are such simple tools that nobody ever stops to think they have a point and two cutting edges that need occasional sharpening. A few seconds at a grinding wheel will greatly increase their efficiency. Sneak the sharpened openers back into the kitchen drawer and watch your wife's look of pleasant surprise when the next juice can surrenders without a struggle.—*W. G. Waggoner, Sacramento, Calif.*






### Lock Feet on Metal Legs

TIGHT as they seem when pushed onto tubular metal legs, rubber crutch tips often pull off when furniture is moved around. To tape or cement them on makes replacement difficult when such feet become worn. A good way to anchor the tips is to raise small barbs in the metal before slipping them on. Punch with a cold chisel held at an angle of about 75 degrees.—*Harry Walton, White Plains, N.Y.*




### Spillproof Dog Feeder

PLASTIC cottage-cheese containers make ideal dishes for our pup—except for one thing: They're so light he has to chase them while he eats. I made a rack from wood scraps to hold a dish for food and one for water. The dimensions aren't critical, but the holes should provide a snug fit. When the dishes get hard to clean, they're easily replaced by new ones.—*John Anderson, Springfield, Ill.*

## HOW TO MAKE AND USE

# An Abrasive-Charged Polishing Wheel

**By R. J. De Cristoforo**

A POLISHING wheel is a cross between a grinding wheel and a buffing wheel. It's a cloth wheel charged with powdered abrasive and glue to combine the fast cutting action of a grinding wheel with the flexibility of a buffing wheel.

You can use polishing wheels to renew cutting edges, renovate rusted or scuffed shop tools, or put a brilliant gleam on rough brass castings. Much of the cost of a solid brass article is for the polishing job. You can save this by buying castings in the raw and doing the polishing yourself.

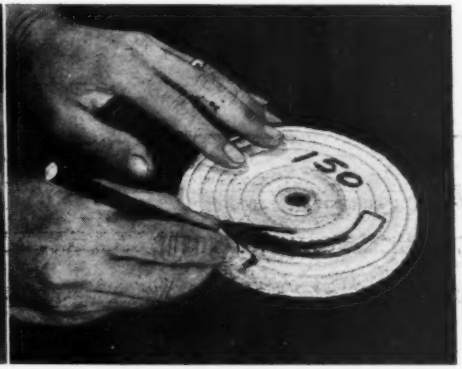
Powdered abrasive is available in many grit sizes, so you can make coarse or fine wheels for grinding, polishing, sharpening, or edge honing.

Polishing a raw casting requires several grit sizes, starting with a coarse abrasive to smooth the rough surface, then working through finer grits to polish it. The final operation is a conventional

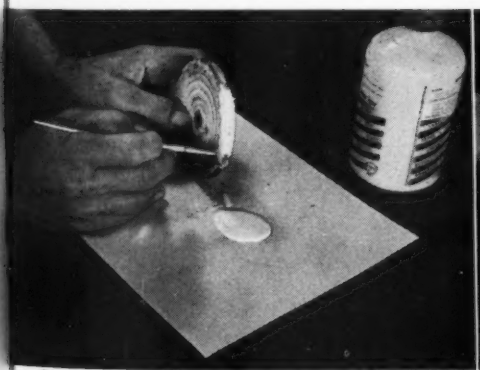
**THAT OLD ABRASIVE MAGIC:** The raw castings shown just above were given a gleaming finish (right) with polishing wheels charged with coarse and fine abrasive. The final polish was applied with an unstitched buffing wheel rubbed with stick compound while running.

## *How to make a polishing wheel*

**USE STITCHED WHEELS** about 6" in diameter, and make a separate wheel for each grit size. Scuff the edge by holding a file against the wheel while running it. Trim off loose threads.



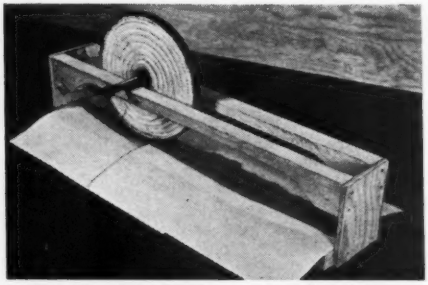

**MARK THE WHEEL** with an arrow, and always run it in the same direction. Also, indicate the grit size for future information when using the wheel or when recharging its edge.



**APPLY GLUE TO THE EDGE** of the wheel, smooth it with your finger, and allow it to dry for 24 hours. Then run the wheel and sand the glue lightly. Any liquid glue can be used.

**ROLL WHEEL IN ABRASIVE** (spread out on wax paper) after it has had second coat of glue. Tap wheel to remove loose particles and hang it up. Repeat in 24 hours to build up abrasive.

CONTINUED



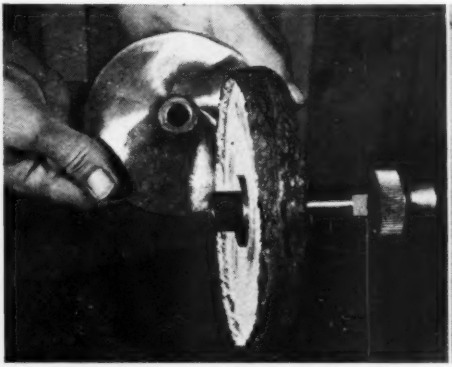
**A JIG WILL HELP YOU** to apply abrasive more evenly. When the charge is dry, tap the edge with a heavy screwdriver to form numerous small cracks and make the coating flexible.

buffing job, using a cloth wheel kept charged simply by rubbing it occasionally with a bar of buffing compound while it is running. Renewing an old hammer head or a pair of pliers requires only a once-over with a medium-grit abrasive.

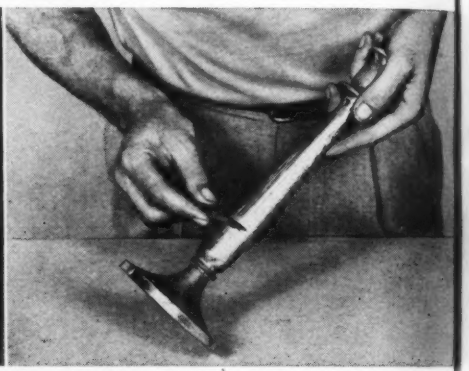
Since polishing wheels actually *remove* metal, it's not a good idea to use them on plated objects—unless you want to work the article down to the base metal to prepare it for replating.

Treat these wheels as you would any grinder. Protect your eyes and your hands. Run them at speeds between 3,000 and 4,000 r.p.m. They'll work at slower speeds, but don't go much higher.

## How to use abrasive-coated wheels

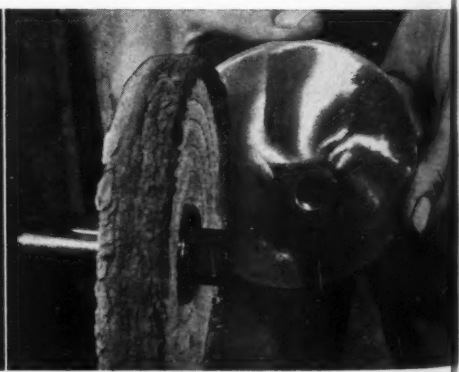


**DEEP PITTING** from rust, or rough sand marks on a casting, can be removed quickly with a wheel coated with 100-grit abrasive. Keep the work in hand moving to avoid deep gouges.



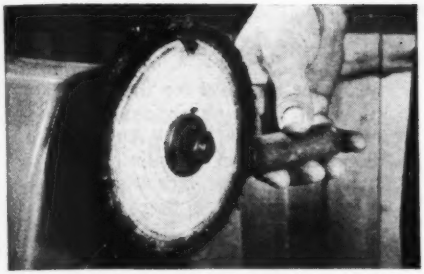
**RAISED POINTS,** sharp corners, and burrs on edges or around nicks should be filed smooth to eliminate danger of snagging or tearing through the abrasive coating into the cloth.

**TO REDUCE ABRASIVE ACTION,** apply a grease stick to the wheel occasionally while using it. Lightly greased, a fine-charged wheel will begin to bring out the luster of the piece.

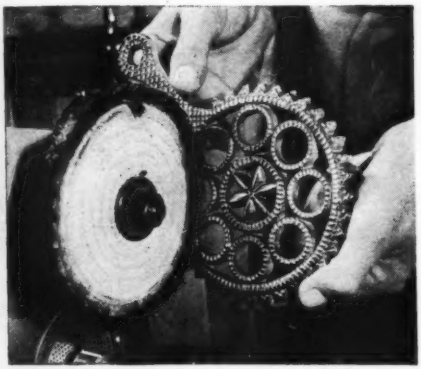


**WORK ACROSS THE GRAIN LINES** left by the cutting-down and smoothing operations. Lessen the pressure of the greased wheel against the work as the fine scratches begin to disappear.

## *Conventional buffing adds the final gleam*

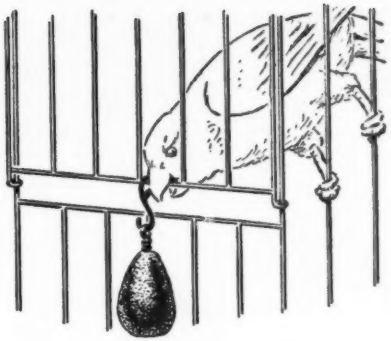


**BAR OF TRIPOLI,** applied to an uncharged wheel, makes it cut lightly to remove faint scratches. Another wheel, rubbed with rouge, will bring out the natural luster of the metal.



**DETAILED SURFACES** such as this are difficult to brighten with an abrasive polishing wheel without removing the detail. Polish with tripoli to bring out highlights, and follow with buffing.

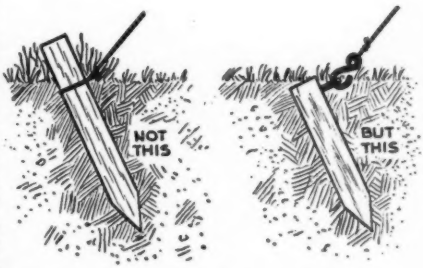
**LOOSE, UNSTITCHED BUFF** will remove finger marks and any residue of the polishing compound. This is just a cleaning operation, so apply light pressure and hold work at edges.



### Escape-Proof Bird Cage

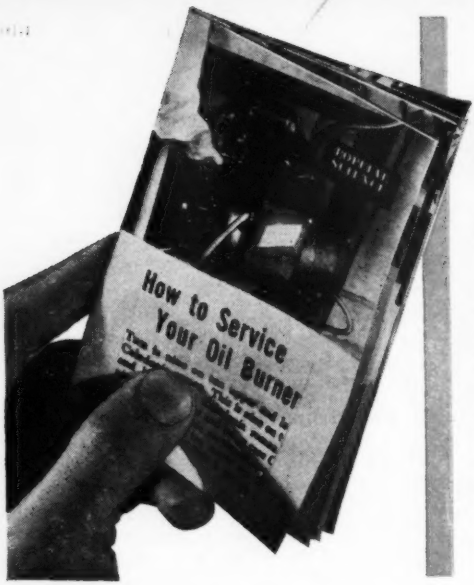
HAS your parakeet learned to lift the gravity-slide door in order to hop out of the cage? Don't bother to tie the door down. Just hang a fishing weight from it on a small S hook. *You* can still raise the door, but no "budgie" can budge it.—*Norman R. Joseph, Lynbrook, N. Y.*

▶▶▶WHERE washing's concerned, our water softener is fine. Drinking's another matter: We don't like the flat taste, or the fact that water won't run cool from the tap. Our house plants didn't like the conditioned water, either. So I installed a bypass pipe to let us draw natural water from the cold faucet at the kitchen sink.—*Bert Brower, Ridgewood, N. J.*




### Buried Stakes Save Stumbles

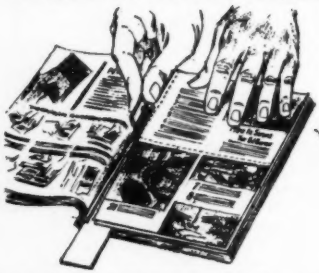
GUY wire or tent stakes driven in only part way are both unsightly and unsafe. Instead of letting them protrude, turn a large screw-eye into each stake, ½" from the top, and drive the stake flush with the ground. Fasten an S hook to the end of the guy wire.—*Harold A. Barfknecht, Dover, Del.*



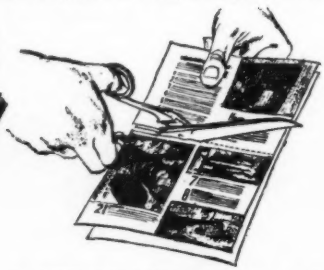

# PS Favorite

Reader requests for this useful booklet, which appeared in POPULAR SCIENCE in August, 1955, have been so numerous that we've exhausted our supply of back copies. So here it is again, as useful as it was six years ago—oil burners run much as they did then. Cut out the booklet and keep it near the furnace to help locate trouble if the burner conks out, and to guide you in maintaining it properly throughout the year.

## *To put the booklet together, just cut, staple, and fold*



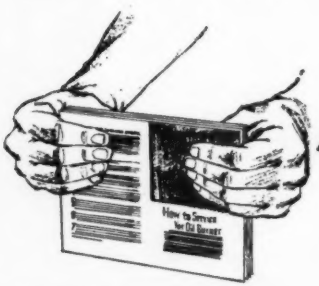
**1. PLACE A RULER** under the two sheets containing this booklet. With a razor blade against it, cut the sheets out.



**2. MAKE A SECOND CUT** across both sheets, following the dotted line on the top page. Keep the sheets aligned.

**3. PLACE** upper half-sheets on top of lower halves. Flip the pages to see that photos 1 to 12 are in numerical order.

**4. TAP THE SHEETS** together on a flat surface to align them neatly with each other. Hold them together firmly.



**5. STAPLE** the sheets together at the centerfold. If your stapler won't reach center, roll sheets over at one side.

**6. NOW FOLD BOOKLET** on the centerline and it's complete. Hang it beside your furnace for ready reference.

## What to Do if the Burner Quits

SHOULD your burner fail during the heating season, first make sure that nobody has cut the main switch by mistake and that the thermostat is set high enough above room temperature to call for heat. Then follow this trouble-shooting list:

1 Check oil supply in the tank. Don't trust the gauge; use a dipstick.

2 Check burner fuses. If blown, replace only with identical ones. If motor hums but won't run, shut it off immediately and call a serviceman.

3 Press reset lever or button on stack control (Fig. 24). If burner starts but shuts off after about 90 seconds, stack element may be dirty. Shut off main switch and clean the element (Fig. 2).

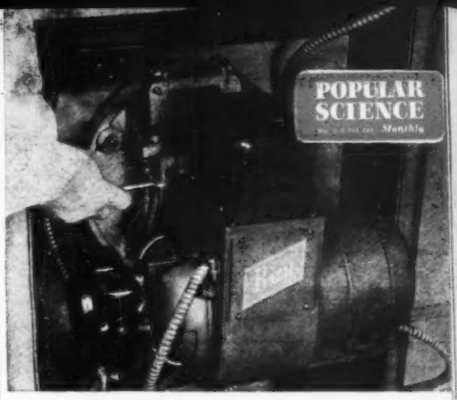
4 Clean thermostat points (Fig. 1). Set thermostat to highest reading. If furnace runs but won't fire, turn off main switch immediately. If there is a strong odor of unburned oil, clean and adjust igniter assembly before trying again.

5 If there is no oil odor after burner runs without firing, or if it fires but sputters out or burns raggedly, shut it off and clean the nozzle (Fig. 7).

6 If burner does not fire after nozzle is cleaned, remove plug from bellows chamber and hit switch to check for air lock (Fig. 25). If no oil appears, the line or strainer is plugged or the pump badly worn, damaged, or not turning.

7 Disconnect the oil line from the igniter assembly and hold a container under it. Turn on the switch momentarily. If no oil appears, the bellows is probably broken.

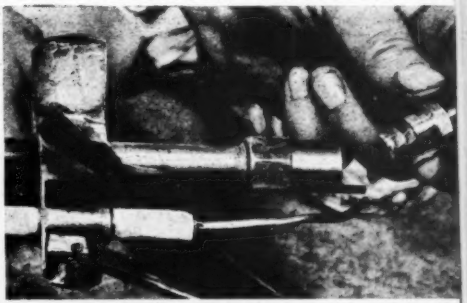
If all these checks fail, or indicate damaged parts, call a serviceman.




# How to Service Your Oil Burner

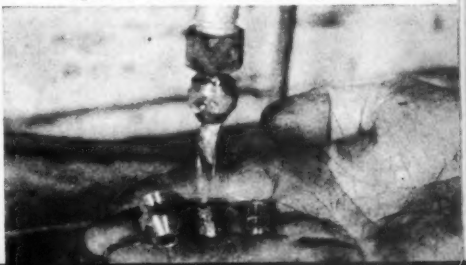
BEFORE touching the burner, shut off the main switch. Then follow the steps in the numbered photos (turn page for Fig. 1). Your burner may have the parts differently arranged, but all gun types have similar components.

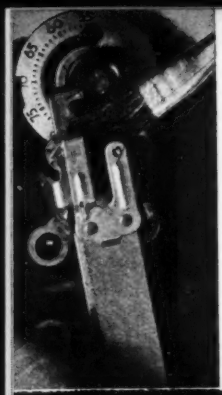
21 **UNSCREW THE BOWL** of the oil filter, clean it, and install new element. Be sure the bowl gasket is intact and connections are tight.



7 **REMOVE THE NOZZLE.** Unscrew screen from inside with fingers. Then hold the nozzle with a wrench, and with a clean screwdriver carefully unscrew the slotted member inside (a scratch is likely to ruin it).

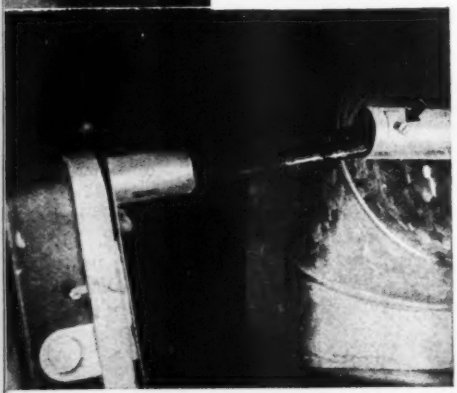
8 **CLEAN SCREEN AND NOZZLE** parts in lacquer thinner or hot running water. Do not wipe dry; lint will clog passages. Air-dry or install them wet. If parts show signs of burning, replace the entire nozzle assembly.

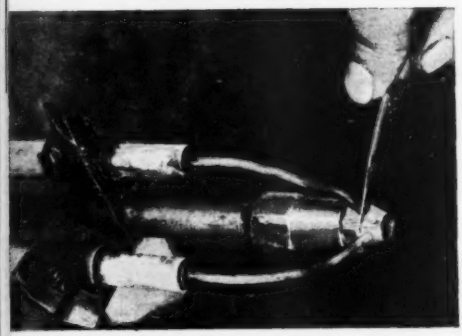




**1** **SET THERMOSTAT** to its lowest reading. Remove the cover. With a soft brush, clean both sets of contacts (tips of the two screws and the tiny inset disks opposite them).

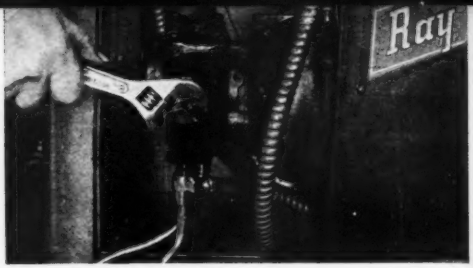
**2** **SHUT OFF** main switch. Locate stack-control box on the smokepipe or furnace. Loosen the setscrew (arrow) and pull the stack element straight out with a twisting motion.





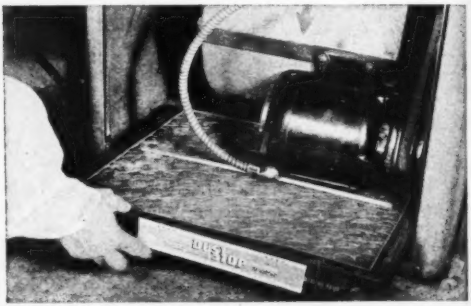
**9** **SCRAPE CARBON** off the electrode tips with a pointed knife blade or sandpaper. If you have already cleaned and reassembled the nozzle, keep the scrapings off by wrapping some clean paper around it.

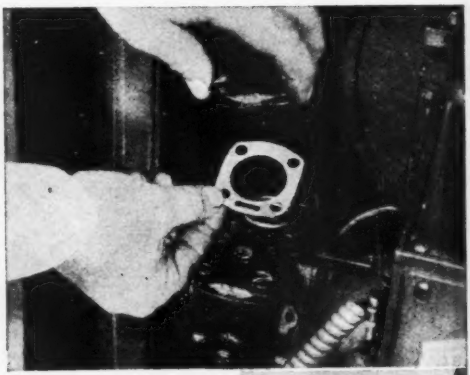
**10** **CHECK THE GAP** between the tips. Reset them to the specifications given by the manufacturer (⅛" is the average setting).




**25** **IF MOTOR RUNS** with no flame or oil odor, or flame goes out but motor keeps running, there may be an air lock. Shut off motor. Remove plug in side of pressure chamber. Switch motor on until oil flows out; then quickly shut off motor and replace plug. If no oil appears, the line or strainer is plugged, or the pump is worn or damaged.

**26** **CLEAN OR REPLACE** air filters in hot-air systems. Shake out or use a vacuum cleaner to remove loose particles of dirt.





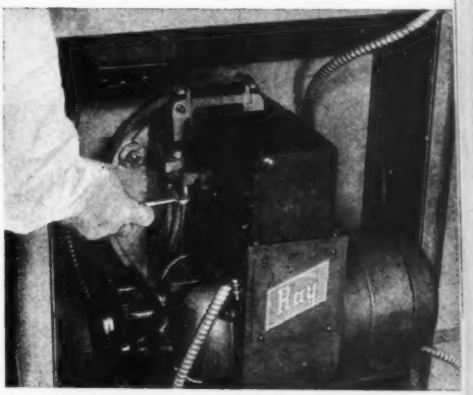
**19** **REPLACE STRAINER** and set gasket back exactly as it came off. If it is cracked or otherwise even slightly damaged, replace it.

**20** **SET CAP BACK** in its original position. To draw it up firmly without strain, first tighten opposite screws, then the other two.

**24** **IF BURNER DOES NOT START,** make sure fuses are good, switch is on, and thermostat calls for heat. Then press and release button on stack control. If this does not start burner, call a serviceman. (Burner can be stopped any time by pressing same button, but will start again after recycling unless the thermostat is turned down or the main switch is shut off.)

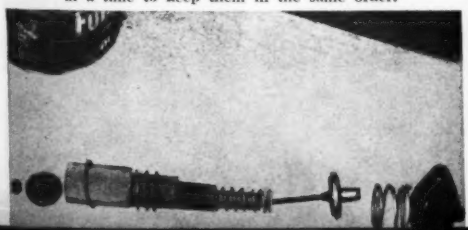
**3** **CLEAN SOOT OFF** stack element with a soft brush (accumulation may hold switch open, stopping burner soon after it starts). Replace stack element and tighten the screw.

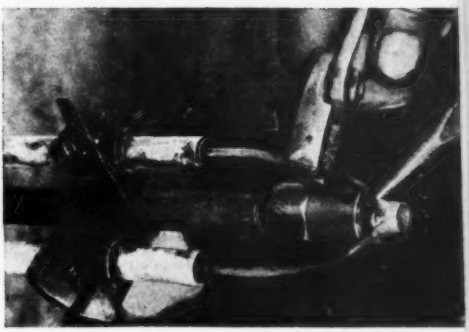
**4** **CLOSE VALVES** in oil line. Disconnect the oil line running to the igniter assembly. (On some burners it may be underneath.)



**17** **WASH THE STRAINER** in lacquer thinner, gasoline, or hot water. If it is very dirty, disassemble and clean its parts separately.

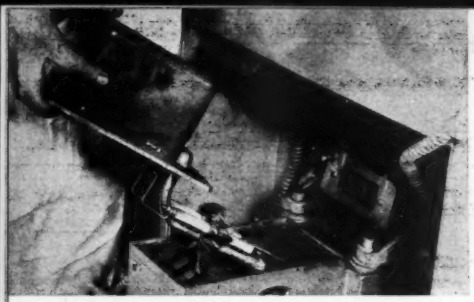
**18** **BY LOOSENING NUT** on bottom of this strainer assembly, its elements can be pulled apart as shown. Lay them on paper and wash one at a time to keep them in the same order.





**11** **USE TWO PLIERS** like this, when bending electrode ends for adjusting the gap, to avoid putting strain on the insulators.

**12** **TIPS SHOULD REACH** to end of the nozzle, not beyond, and should be ⅜" above or to one side, out of line of the oil spray. To adjust lengthwise, loosen the clamps and slide the insulators in them.

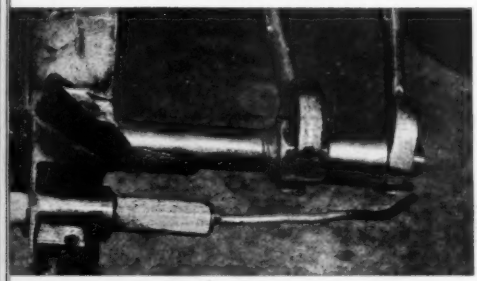


**5** **REMOVE SCREWS** holding the igniter assembly in place, and draw it out. In this burner, it is mounted below a plate carrying the transformer on top. Brush soot off the insulators, electrodes, and air vanes.

**6** **USE TWO WRENCHES** to remove the nozzle assembly, taking care not to hit the electrodes or fragile porcelain insulators. Holding the rear-most nut, unscrew the front one (counter-clockwise, seen from the end).

**22** **OIL THE MOTOR,** using only three or four drops of light engine oil such as SAE 10. Do this every six months. Oil motor on hot-air blower or water circulator the same way.

**23** **OPEN OIL VALVES** and turn on main switch. Turning thermostat up should start burner. Observe flame, adjust air. On this burner, lever controls it; on others, a slotted segment held by setscrew. Flame should have orange tips without smoke. A smoky flame soots the furnace, needs more air. Too much air causes white flame and wastes oil.



**13** **TO TEST IGNITION** and condition of insulators, connect primary transformer terminals directly to 115-volt line; place disconnected oil line in can and turn on switch. A steady spark should hop the gap. If spark appears elsewhere, install new insulators.

**14** **BEFORE REPLACING** the igniter assembly, use a clean brush to clean the blower fan. Also see whether there is any oil in the firebox. If so, it indicates a worn shutoff valve. This should be replaced by a serviceman.

**15** **BEFORE TRYING** to remove the strainer for cleaning, be sure to identify its cap. On this burner, it bears the letter S. Other cap covers the bellows chamber. It should not be removed. Make a sketch of the cap markings so you can replace it same way.

**16** **TAKE OUT** the screws that hold the strainer cap. Set them, with the cap and its gasket, carefully aside on a piece of clean paper. Then lift out the large spring and draw out the strainer assembly as shown below.

# Why Let Your Snow Tires Loaf?

***Here's a smart stunt: Put your winter treads to work in a year-round rotation plan***

**By Millard F. Kirk**

SNOW treads louse up normal tire-rotation plans by throwing the order off and requiring you to switch casings as well as wheels every spring and fall. Here's a solution I've used for years that's a real humdinger, but apparently not widely known. It lets you buy two snow tires for the price of one and rotate them throughout the year as easily as changing a flat. Here's how the system works:

It starts with the purchase of a new car. As part of the deal, trade the spare tire you get with the car for a new snow tire. (I've done this on two new cars and have found you can work it at no additional cost.) At the same time, buy a second new snow tire and a separate wheel for it. If you do this when you purchase the car, the dealer will

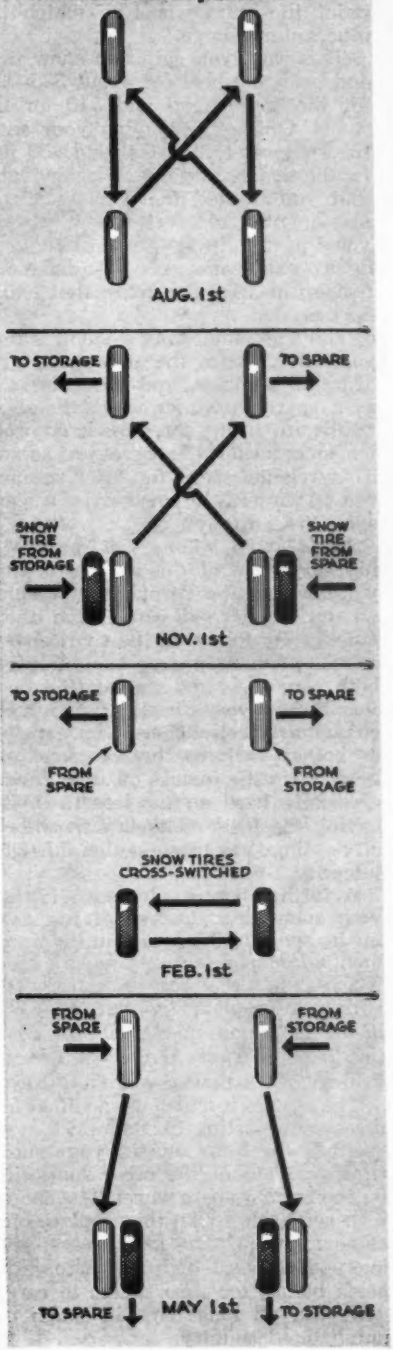
CONTINUED

***How snow-tire rotation saves wear on regular tires, too***

| Tire | WHERE USED* | | | | Percent of Normal Year's Wear |
|---|---|---|---|---|---|
| | Left Front | Right Front | Left Rear | Right Rear | |
| Regular Tire #1 | ✓ | ✓ | | ✓ | 75 |
| Regular Tire #2 | ✓ | ✓ | | ✓ | 75 |
| Regular Tire #3 | ✓ | ✓ | ✓ | | 75 |
| Regular Tire #4 | ✓ | ✓ | ✓ | | 75 |
| Snow Tire A | | | ✓ | ✓ | 50 |
| Snow Tire B | | | ✓ | ✓ | 50 |

*Note: Each check represents 3 months for a given tire at the location indicated.

***How to rotate your tires with the new plan***



paint the extra wheel to match the others at no charge.

This way, you gain two snow tires and a sixth wheel for about $35—$25 for the snow tread and $10 for the wheel. Ordinarily, buying your snow tires separately, you'd spend $50 just for the treads. And if you decided later that you wanted the convenience of permanently mounted snow wheels, you'd have to invest an additional $20 in *two* extra rims. You also have $25 tied up in a regular spare that really isn't needed.

The trick, under my system, is that you carry one of the snow tires as a spare in summer, and a regular tire as a spare in winter when the snow treads are on the car. This is no problem since a snow tire serves just as well as a regular spare for brief summer use. In winter, who ever carries a spare snow tire, anyway?

***Besides the money you save:*** The big advantage of this system is that you have all tires permanently mounted on wheels and can switch them quickly. By following the chart shown on the previous page, you can rotate both your snow and regular tires on a four-times-a-year basis by merely changing wheels. There's no expense or bother to have the job done, no need to rip the casings off their rims—especially hard on tubeless tires. By having the tires on their own wheels all the time, you preserve their airtight integrity.

A further happy advantage is that your snow tires, instead of just taking up space in the garage in the warm months, keep on serving you, as spares. The amount of wear each tire gets, with rotation under my plan, is shown in an accompanying table. Any rotation plan, of course, gives you the advantage of equalizing wear on all tires.

The system can also be modified for use on an existing car. Simply buy a "sixth" wheel for one of your snow tires, and mount the other snow tire on the regular spare wheel. The spare, if in good shape, can then replace one of your present tires as it wears, saving you the cost of a new tire. You get a bonus, too—*two* spares to carry with you on long trips in rough or uninhabited country. ■ ■



# The Fast Way to Turn Snapshots into Slides

**By Ronald L. Hunt and John Overton**

*Mr. Hunt is Director, Community Educational Resources, and Mr. Overton is Audio-Visual Technician, for the San Diego County Department of Education.*

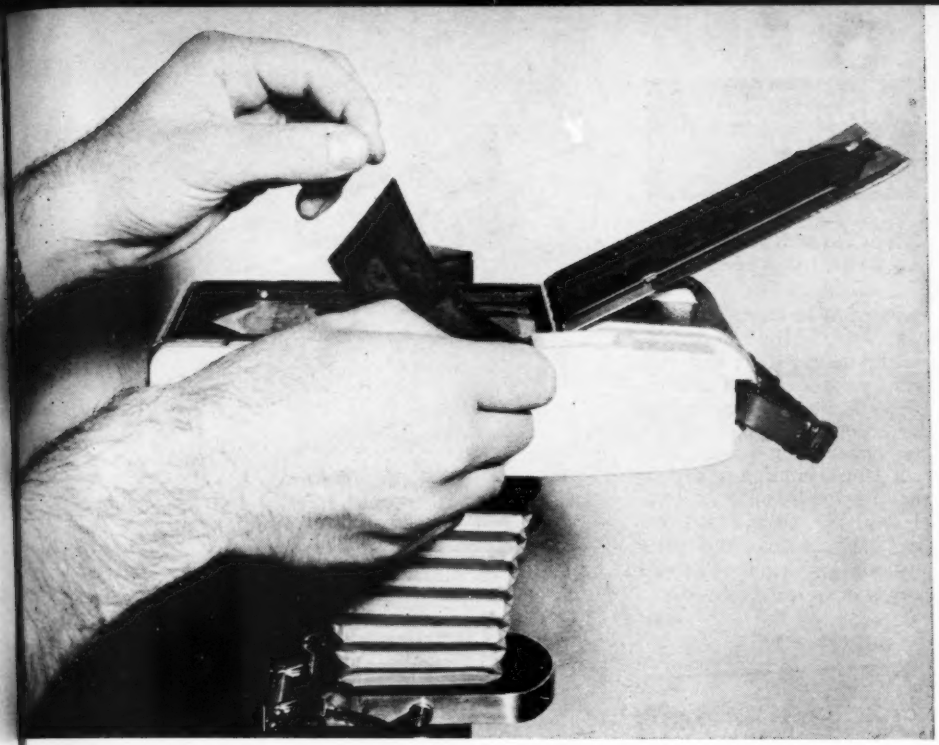
YOU click the shutter only once and in two minutes end up with *four* 2″-by-2″ slides ready for mounting. There's no quicker way to turn your old or new snapshots into transparencies that you can project wall size.

All you have to do is copy your present prints with a quick-developing Polaroid camera loaded with Type 46-L Land Projection Film. This film fits all Polaroid cameras except the small 80 series models. You also need a Polaroid Copymaker stand that holds the camera, and is equipped with lights and timer.

By following the Copymaker's exposure chart, you can turn out four positive transparencies grouped side by side on a single sheet of film. After development, the transparencies are simply cut apart and mounted in standard 2″ -by-2″ slide binders for projection.

***How the method works.*** Use a black cardboard mask about 10½″ by 14″ to fit the Copymaker's easel, and cut windows in the mask to suit the size of your prints. Space the windows 1½″ apart.

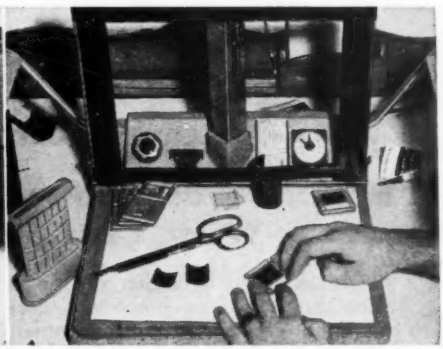
After exposure, pull the tab to start the two-minute developing process; then tear



the film from the camera back just as you would a print. But instead of coating it, run it through a Polaroid Dippit—a hand-held tank of emulsion-hardening solution. Allow the film to dry for at least five minutes; then trim the slides to fit the binders.

***Ease and economy.*** Because it's fast and cheap, you can duplicate all your snapshots as soon as you take them. A roll of eight pictures can be converted for projection by using only two pieces of 46-L film. And if you wish to make slides of cartoons, maps, charts—any black-and-white line drawing—there's a special new film (146-L PolaLine projection film) for that. It's the same size as 46-L, but develops in 10 seconds.

**PHOTOS TO BE COPIED** fit under a four-window mask. Results are best with photos of matching contrast. Make sure that no borders show.



**STANDARD SLIDE MOUNTS** are used for the four transparencies that result from quartering the film. Cut slides apart along mask spaces.

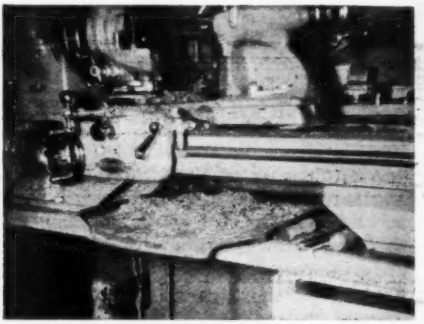
## Short Cuts and Tips
FROM PS READERS

### The Safest Way to Clean Gutters

I GOT tired of shifting the extension ladder along the eaves each time I had to clean debris from the gutters. So I drilled a hole in the end of a long pole and wired on three pieces of old tire chain and a weighted tin can. Running the pole against the lip of the gutter, I trail the chains and the can inside. Leaves and twigs fly out, and at the end of the gutter the can scoops up the residue. The job goes fast and I never leave the ground.—*Clarence W. Winchell, Hackensack, N. J.*

### Steel-Wool Rope for Turnings

STRIPPING the finish from turned legs or spindles? The best way I know to clean up those crevices is to twist steel wool and a strip of rag into a rope as shown.—*Jerry Beebe, Peru, Ind.*



### Chip Catcher from Dish Drainer

A RUBBER or plastic dish drainer is fine for catching the chips that fall constantly beneath the lathe bed. At clean-up time, just dump the drainer.—*John G. Lownsbery, Richmond, Va.*

## .....WHAT'S YOUR ELECTRICAL IQ?.....

### The Case of the Wrong-Way Fan

AFTER taking the induction motor of a small household fan completely apart to clean and oil it, Steve put it together, replaced the guard and fan blade, and was delighted to find that it ran quietly and briskly.

A moment later, though, he was chagrined to notice that the whirling blade produced no breeze. The fan was throwing air backwards, and poorly at that.

Hastily Steve removed the fan and turned it around on the shaft. To his amazement, the thing persisted in blowing backwards.

How come?

*Answer on page 187*

**NEW LOOK IN HI-FI?** The "Multi-24" uses 20 six-inch woofers (five are in the bottom facing the floor) and four cone tweeters. At right: plastic rubber seals speakers to the front of the panel.

# The More the Mellower

## . . . hi-fi from 24 cheap speakers

**By James D. Reid**

"IT'LL probably sound just like 24 cheap speakers," my neighbor quipped. I was nervously putting the finishing touches on a speaker system using 20 small woofers and 4 tweeters.

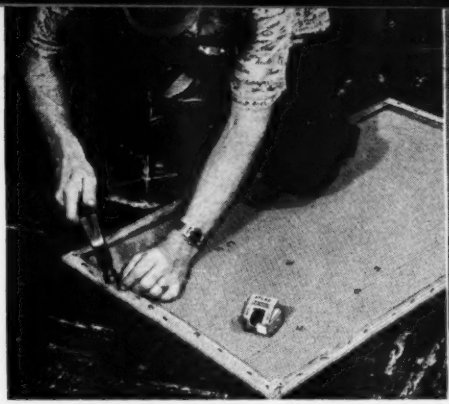
"Just so it doesn't sound 24 times as bad as *one* cheap speaker," I replied.

Getting high-quality sound from low-quality speakers didn't seem reasonable. But articles by sound engineers about the advantages of this approach had made me curious. I had invested almost $70 in the project. Now I was almost afraid to listen.

When we connected the unit to my amplifier, all doubts disappeared. It sounded great. The bass was solid. The highs sparkled; voices sounded natural. A frequency test record revealed useful, audible output from 30 cycles on up. Most important, the music sounded real.

After some minor changes, I invited in a jury of fellow sound enthusiasts. One neighbor brought his highly rated speak-

CONTINUED



**REMOVABLE GRILLE** covers front of cabinet. Make frame of hardwood strips for a snug fit in front opening. Wrap grille cloth around frame, stretch it tight, and tack it in back.

**FIVE WOOFERS ON THE BOTTOM** are mounted on the inside of the bottom panel. Tack strips of felt or carpet padding to the bottom of the pedestal. Short legs could replace pedestal.

er (an AR-3) to serve as a reference. We played jazz, classics, demonstration records. Some of the listeners preferred the dry, analytical quality of the AR-3 with its extended bass and brilliant tweeters, but others (bless them) went for the "warm" tone and the effortless response of the new system.

***High-low performance.*** There were differences between the two, but these were amazingly slight in view of the three-to-one difference in cost. At the high end, 15,000 cycles came through clearly on both, and either one rattled the windows satisfactorily at 50. Below that, the commercial unit had the edge over my "Multi-24" (as it has over almost every other speaker under $700). The Multi's broad source of sound and impeccable response to quick, sharp sounds (guitar, drums), however, was unbeatable. On an audio-signal generator, no dips or peaks were audible. In fact, I think the Multi is the equal of the best speakers in the $200-to-$400 price range.

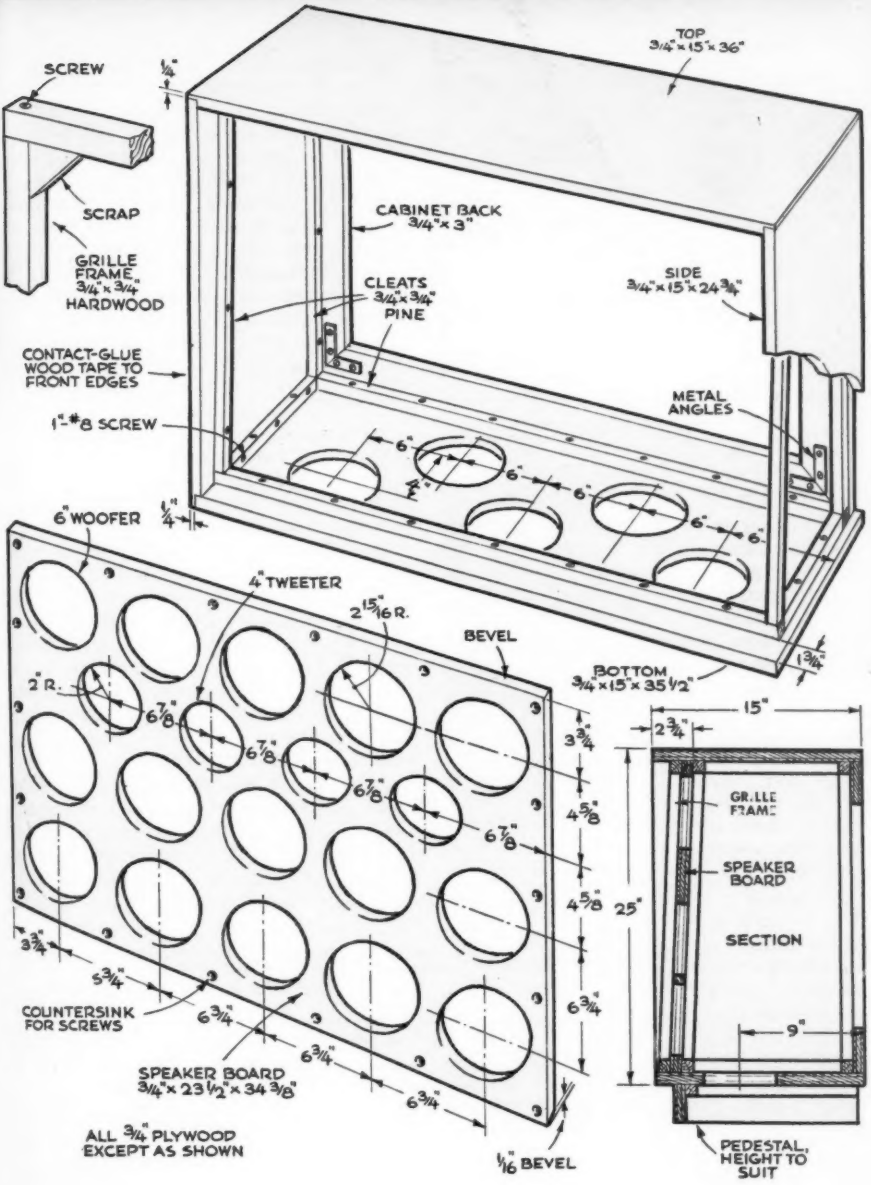
The idea of adding speakers to produce better low-frequency response is not new. Manufacturers have been building systems with two and four woofers for years. But combining 15, 20, or even 30 small, inexpensive speakers is a radical approach. Audio engineers claim these advantages:

- Good bass output. The total area of the 20 cones is roughly that of two or three 15″ speakers.
- No "boom in the bass" and cancellation of peaks and dips in the frequency response.
- Excellent transient response (reaction to quick, sharp sound). These small speakers have light, rigid cones.
- High efficiency. A 10-watt amplifier is sufficient.
- Great power-handling ability. Each speaker is rated at 3 or 4 watts, so 20 can handle at least 60 to 80 watts.
- Low distortion. Each speaker produces only a small proportion of the sound.
- Low cost.

I was so pleased with the performance that I immediately built a second speaker for stereo. The broad source and excellent dispersion of the highs produce fine stereo. The familiar hole-in-the-middle problem just doesn't exist. But the real ear-opener is the way monophonic records sound through both banks of speakers. Forty woofers working in unison create a solid wall of sound of unbelievable realism.

***Construction is simple.*** The enclosure is little more than a box with holes in front and bottom. Being shallow, the multiple speaker lends itself to wall installation.

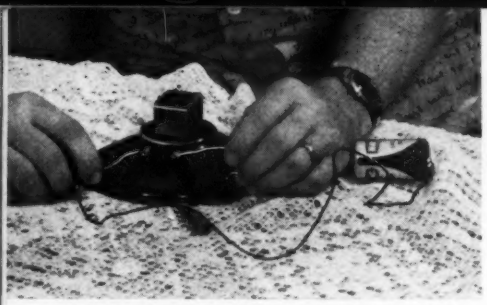
While the speakers can be mounted in the usual way (as the bottom speakers are), I mounted the front-panel ones on the *outside*, using "plastic rubber" for an airtight seal. This improves dispersion of the higher frequencies. The front-panel speakers were installed and wired before I secured the panel to the cabinet with glue and screws. The cabinet back is an open frame of ¾″ plywood to which are tacked two layers of 1″ fiber-glass.




**LIST OF MATERIALS**

*6" speakers, 1-oz. magnet weight (20)*
*3½" or 4" cone tweeters (4)*
*¾" plywood panel, 4' x 8'*
*¾" x ¾" pine strips, 10' long for cleats (4)*
*¾" x ¾" hardwood, 10' long for grille frame (1)*
*#18 hookup wire (10')*
*4-mfd. nonpolarized capacitor (crossover)*
*#8 x 1" flathead wood screws (1 gross)*
*#6 x ½" roundhead wood screws (96)*
*Tube, plastic rubber*
*1" fiber-glass (3 yards)*
*1" wood tape (10')*
*Two-post terminal strip*
*Acoustic grille cloth, 27" x 38"*
*Flat black paint for speaker panel*
*Stain, varnish, or lacquer for cabinet finish*

CONTINUED



**FIND POLARITY OF EACH SPEAKER:** Touch wires from flashlight battery to speaker terminals. When speaker cone moves out, mark terminal ("plus") connected to positive pole of battery.

**CONNECT SPEAKERS** with #18 hookup wire, following wiring diagram below. Check with flashlight cell to be sure all cones move in the same direction; then solder all connections.

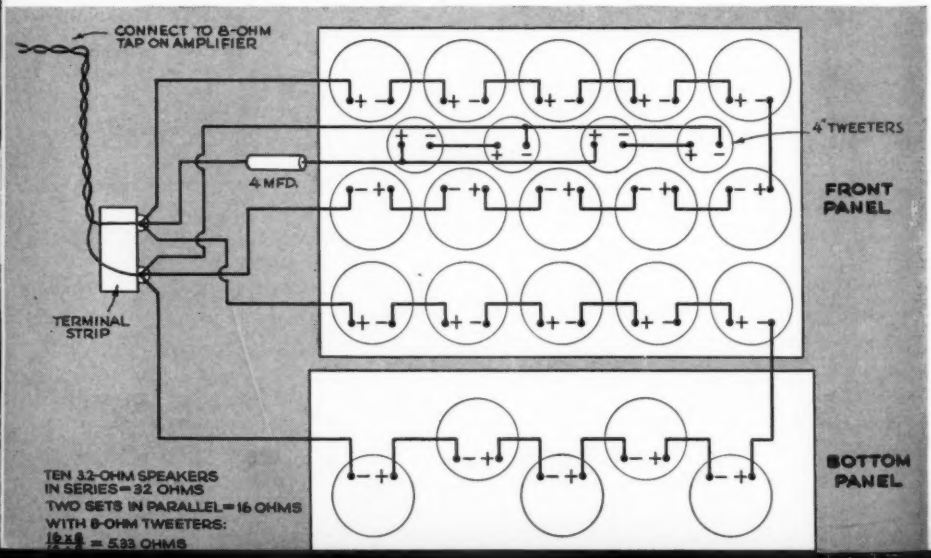
The inside is padded with the same stuff.

The 6″ speakers, obtainable at most radio-parts stores for about $2, have a voice-coil impedance of 3.2 ohms and a magnet weight of 1 ounce. It is not necessary, or even desirable, for all speakers to be of the same brand, but magnet weight (and therefore efficiency) should be the same. By wiring the speakers in a combination of series and parallel, the impedance can be matched to any high-fidelity amplifier.

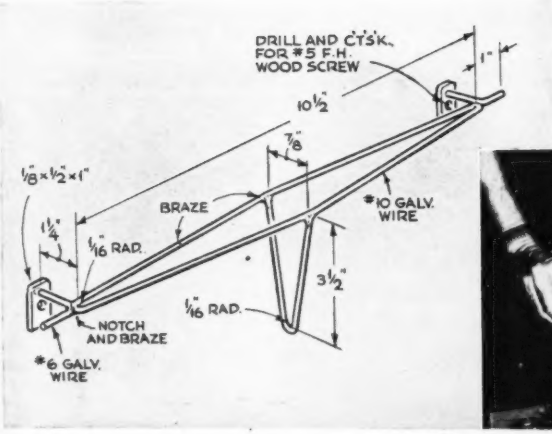
***The tweeters.*** I used 4″ hard-cone units, but other sizes and types will do. Three-inch ones might even work better. Horn-type compression tweeters, though more expensive, are more brilliant. I chose cone tweeters for smoothness. A 4-mfd. nonpolarized capacitor in series prevents low frequencies from getting into the tweeters.

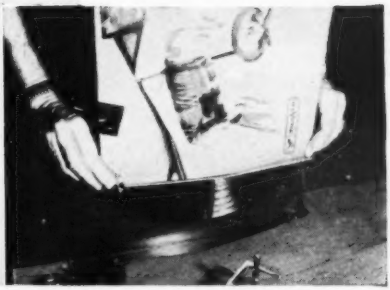
Before wiring the speakers, check each for polarity to make sure that all will be working together—the secret of good bass performance. This is easily done by momentarily connecting a 1½-volt dry cell to the speaker terminals. If the cone moves out, mark the speaker terminal that is connected to the center conductor of the dry cell: This is the "plus" side on the wiring diagram.

The overall impedance is five ohms, and the connection is made with any length of lamp cord to the eight-ohm tap of the amplifier. The enclosure should be set no closer than 2″ or 3″ to a wall and, preferably, on a rug or carpet. ■■


CONNECT TO 8-OHM TAP ON AMPLIFIER
4 MFD.
4" TWEETERS
FRONT PANEL
TERMINAL STRIP
BOTTOM PANEL
TEN 3.2-OHM SPEAKERS IN SERIES = 32 OHMS
TWO SETS IN PARALLEL = 16 OHMS
WITH 8-OHM TWEETERS:
16 x 8 / 16 + 8 = 5.33 OHMS

## Short Cuts and Tips
FROM PS READERS



### Keeping the Record Clean

SURFACE noise from fingerprints is even worse on stereo records than on ordinary LPs. I devised this record cradle and licked the problem completely in my house. The open, diamond-shaped design eliminates the need for grit-catching padding, since only the edges of the records now touch anything.

With the cradle screwed to the inside of the record-player cabinet, the open end of the record jacket is centered over it, using the end guides as shown in the photo. Squeeze the jacket to bow the sides and the record slides gently into the cradle. Lift off the jacket and it's now quite easy to handle the record by the rim. Fingerprints are almost impossible.—*J. R. Harman, Grand Rapids.*

### Nonsticking Paint-Tube Caps

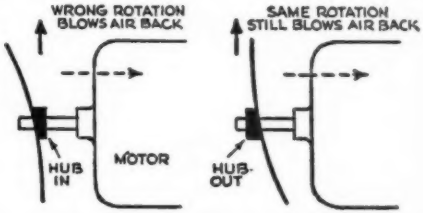
TUBES of artist's colors usually become smeared with paint at the tip. If you apply petroleum jelly to the threads the first time you use the tube, the cap won't stick when it's replaced. This also provides an air seal that reduces the drying out of water or oil pigments.—*Walter E. Burton, Akron, Ohio.*

## Answer to the Case of the Wrong-Way Fan

*(See page 182)*

REVERSING a fan or a propeller in its shaft does not reverse the flow of air it produces. It can only cut its efficiency by putting the concave side of the blades on the wrong side (they should face the way air is to be delivered).

Steve's trouble was that the shaft was running backwards. This was because, in reassembling the motor, he had turned




the field unit around. In a shaded-pole induction motor, this reverses the shaded poles, starting the rotor in the reverse direction.

To set things right, Steve had to turn the field unit back to its original position.

# New Ideas in Photography

**YOU WON'T BELIEVE IT** till you hear it—the rich, clear-as-a-bell sound of the Kodak Sound 8 Projector!

## Make your 8mm movies come alive with sound!

Now you can add rich, stirring sound to your 8mm movies—new or old. And you can use your present camera.

All this is made possible by Kodak's discovery of a way to put quality magnetic sound on narrow 8mm film—and by the Kodak Sound 8 Projector, which both records and plays back the sound.

You simply take your processed film to your dealer. Ask him to have a magnetic stripe, such as Kodak Sonotrack Coating, applied to the film edge.

As you project the "striped" film through your Sound 8 Projector, talk into the mike to record voice commentary. For music and sound effects, hook in your record player or tape recorder.

You can play back your new sound movie instantly. To improve any sections of sound, just reverse the film and re-record; erasure of previous sound is automatic.

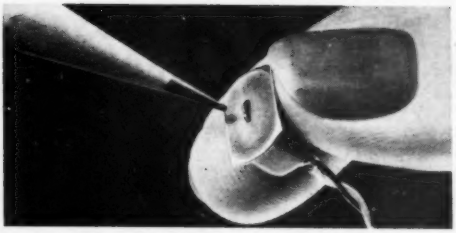
Kodak Sound 8 Projector, with microphone and built-in speaker, is less than $350. See your dealer for exact retail price. Many dealers offer terms as low as 10% down.

**RECORD RIGHT ON THE FILM**—voices or "live" sound effects through mike, music from your record player or tape recorder. Play back through projector's built-in speaker, through your present hi-fi equipment—or through both!

# from Kodak

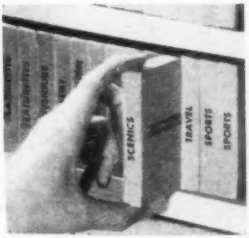
**LONG-PLAY (33⅓) RECORD OF BACKGROUND MUSIC** and special sound effects comes with your Kodak Sound 8 Projector. These high-fidelity musical selections are adaptable to just about every situation you're likely to capture on film. Thirteen common sound effects are also included.

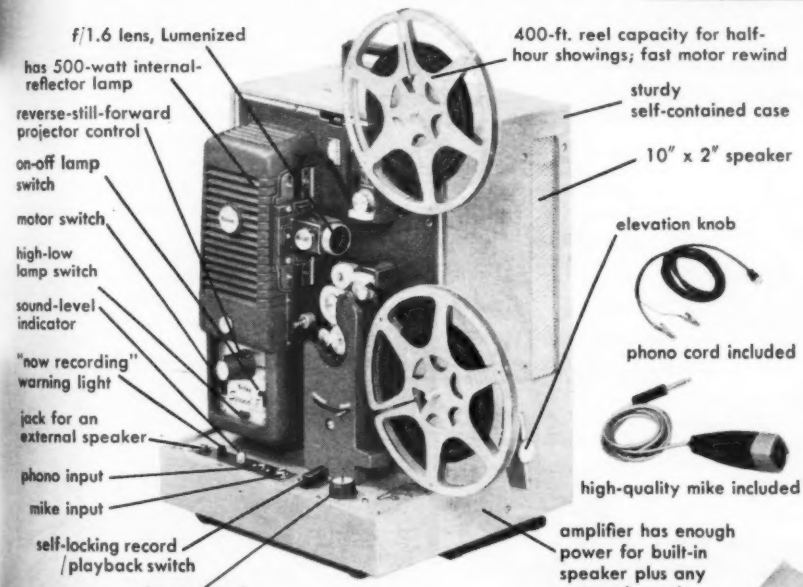
(Below) **TWO FINE INSTRUMENTS IN ONE:** the Kodak Sound 8 is a top-quality 8mm projector that gives you sharp, clear movies up to 5 feet wide. It also is a fine sound system with frequency response 70 to 7,500 cycles. Projector will never need oiling.



**SOUND PICKUP HEAD** is only 2/100″ wide. It would wear away fast if made of the usual magnetic alloy. Kodak head is made of new, incredibly hard Alfenol alloy, is virtually wearproof. Will record for countless hours without loss in sound quality.

**PROFESSIONAL** 8mm sound films are now available for sale or rent . . . and many more are coming. The Kodak Sound 8 Projector runs at 24 frames per second for professional films, and at 16 fps for most personal films.



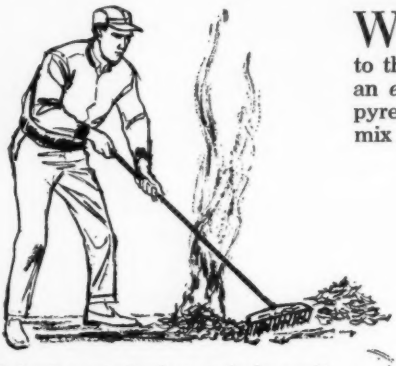

*Price is subject to change without notice.*

**EASTMAN KODAK COMPANY,** Rochester 4, N. Y.

Kodak
TRADEMARK

Enjoy Walt Disney's "Wonderful World of Color" Sunday evenings, NBC-TV

# Bits About Bonfires

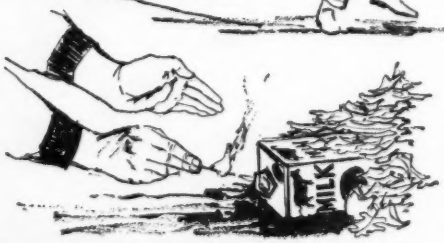


WHEN it's fall cleanup time, we call the burning piles bonfires, but the word doesn't refer to the French *bon*. Someone, way back, dropped an *e*. The original word was *bonefire*—a funeral pyre. Very fitting, say fire underwriters, if you mix a bonfire with carelessness.

**To burn leaves safely,** keep the bonfire small. Many people make them too big. They pile on leaves and limbs until sparks swirl away and start a new fire.

**Select a spot** where winds can't carry sparks and hot ash to inflammable materials. Rake the surrounding area free of leaves and debris. Never leave the fire untended and, as a further caution, keep a pail of water on hand. In case of a sudden wind storm, use the water immediately.

**A sling for safe bonfires** can be made from canvas, cloth, or plastic. Use a piece about 5′ square, and tie heavy cord to each corner. Rake leaves on it, pull one side over the other, and lift it off the ground. Unroll the leaves in a sling-width "train" at the burning area and light one end. They'll burn slowly and safely.




**Burning damp leaves** is easy when you know the trick. Pile a small quantity around a waxed milk carton and light it. The burning wax will provide enough heat to ignite the leaves and keep them burning as you add more.

**Better than a bonfire** is a compost heap for disposing of your autumn leaves. After a season or so, they'll have rotted down into fine, costfree fertilizer.

# GET SET FOR THE FALL AND WINTER JOBS

## Set up a Weldwood Fix and Finish Shelf in your workshop

**FINISH DOORS** with Weldwood Satinlac®. A complete finish—it seals, primes, finishes! Assures a glowing, soft-sheen luster. Brings out the wood's natural beauty without "plate-glass" shine.

**MEND A DRAWER** with Weldwood Presto-Set® Glue. Quick, clean, dries fast, won't stain. Bonds paper, wood, cloth, china. In handy bellows-action squeeze bottle with spreader top. From 39¢.

**EDGE A COFFEE TABLE** with Weldwood Flexible Wood-Trim®. Real wood, paper-backed, in handy 8' rolls. Use it to finish off any Plywood project or as decorative trim. Apply with Presto-Set Glue.

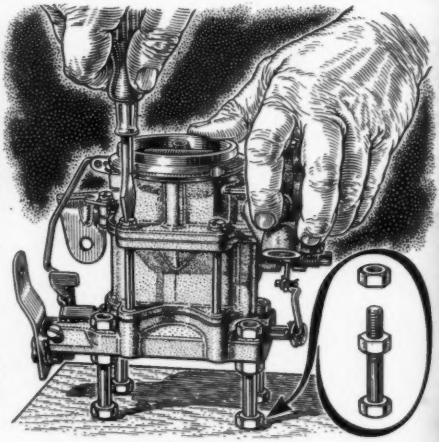
Save time and trouble. Keep the Weldwood® adhesives and finishes you'll need this fall and winter on your workshop shelf—and you're ready for almost any job when it arises. For a starter, you might get these products for this year's inside-the-house projects: Weldwood Satinlac, Presto-Set and Plastic Resin Glues, Wood-Trim, Firzite, and Putty Stiks®. You'll find them at your local lumber yard, or paint and hardware stores.

ADHESIVES
**WELDWOOD**
WOOD FINISHES

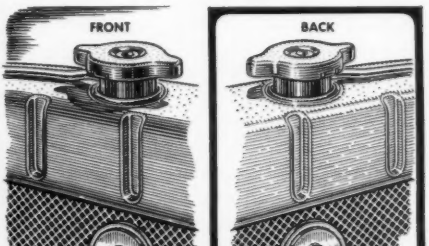
*Products of United States Plywood*

# Hints from the Model Garage

**An old overshoe** makes a handy, rattle-free case for storing a tow chain or other metallic object that clanks and clatters on the floor of the trunk. Quart-size oil cans will also fit in the shoe to keep them from rolling back and forth.



**A steady work stand,** made by locking four bolts in the holes at the base of a carburetor, will protect the linkage and throttle valves, and permit them to move freely while you're cleaning or overhauling the unit. Use two nuts on each bolt.



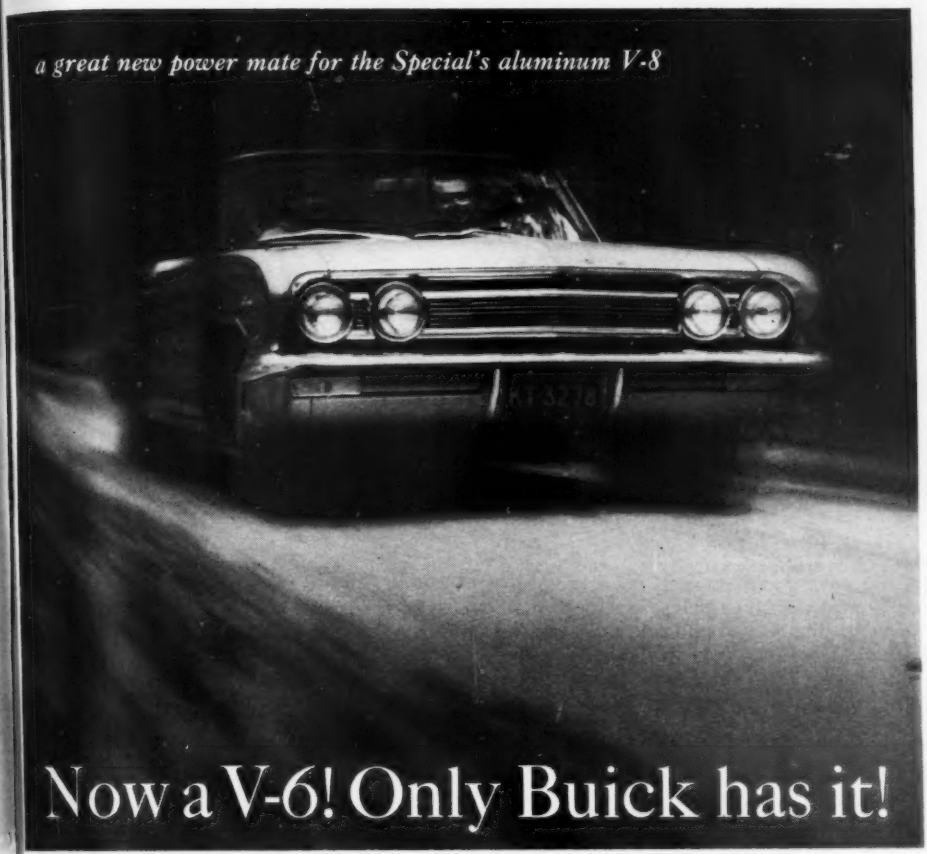

**Radiator leaking?** Expensive repairs can be postponed or avoided by sealing the ends of the core on both sides of the leak with disks cut from inner tube. Clamp the rubber in place with disks of metal, washers, and a long, thin bolt.

**A plastic clothes bag**—the kind you get free from the cleaner—slipped over the spare tire will keep the usually dirty wheel from soiling things carried in the trunk. Wrap the jack and lug wrench in a bag, too, for the same reason.



CONTINUED

*a great new power mate for the Special's aluminum V-8*



# Now a V-6! Only Buick has it!

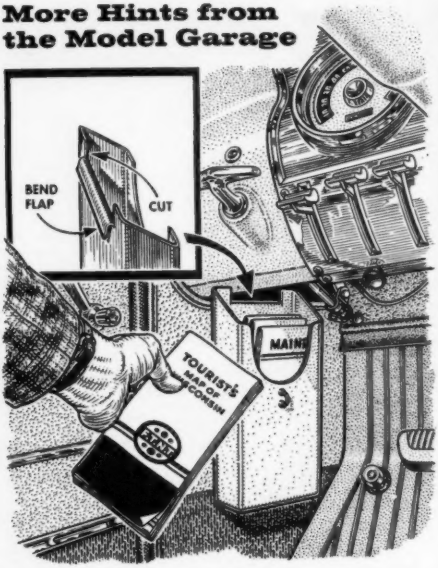
**Six for Savings—V for Voom.** It was natural that it came from Buick. Natural that Buick developed the successor to the in-line six-cylinder engine... *the V-6!* A V-6 you can now get in the new 1962 Buick Special (in convertible, sedan or station wagon models). A V-6 that has 140 to 179 pounds less weight than in-line sixes of comparable power. A V-6 that gives you the V-smooth, V-lively *Voom* of big cars *plus* gas economy that challenges the compacts. A V-6 with the shortest, most rigid block and crankshaft in any American 6-cylinder car.

Why is it natural that this great engine should come from Buick? Because it was Buick which also developed an *aluminum V-8* which you can also get in the Buick Special. This is the V-8 that gives you sizzling go, yet swept its class in 1961's Mobilgas Economy Run against the country's top drivers. It's natural that it should come from Buick, too, because so many other great automotive advances *have* . . . such as today's safe, simple directional signals . . . fin-cooled aluminum brakes . . . the first no-shift transmission . . . the first hardtop. So here again you have exciting proof that when better automobiles are built, Buick will build them. Buick Motor Division—General Motors Corporation.

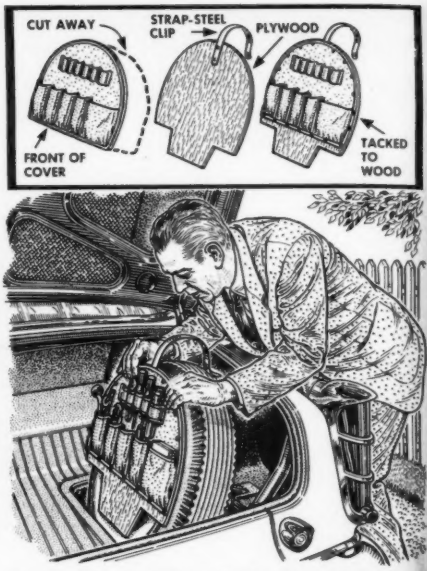
## '62 Buick Special V6 V8

*The happy-medium size*

## More Hints from the Model Garage

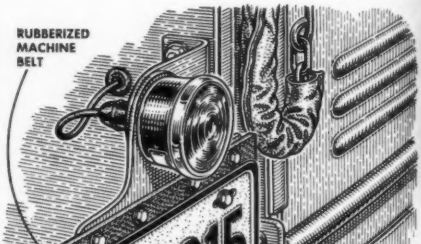



**A file case for maps** will keep them orderly and within easy reach. An old mail box with the cover removed makes a slim holder. Make two cuts in the back at the top, bend over a flap, and hang the box on the edge of the scuff panel.

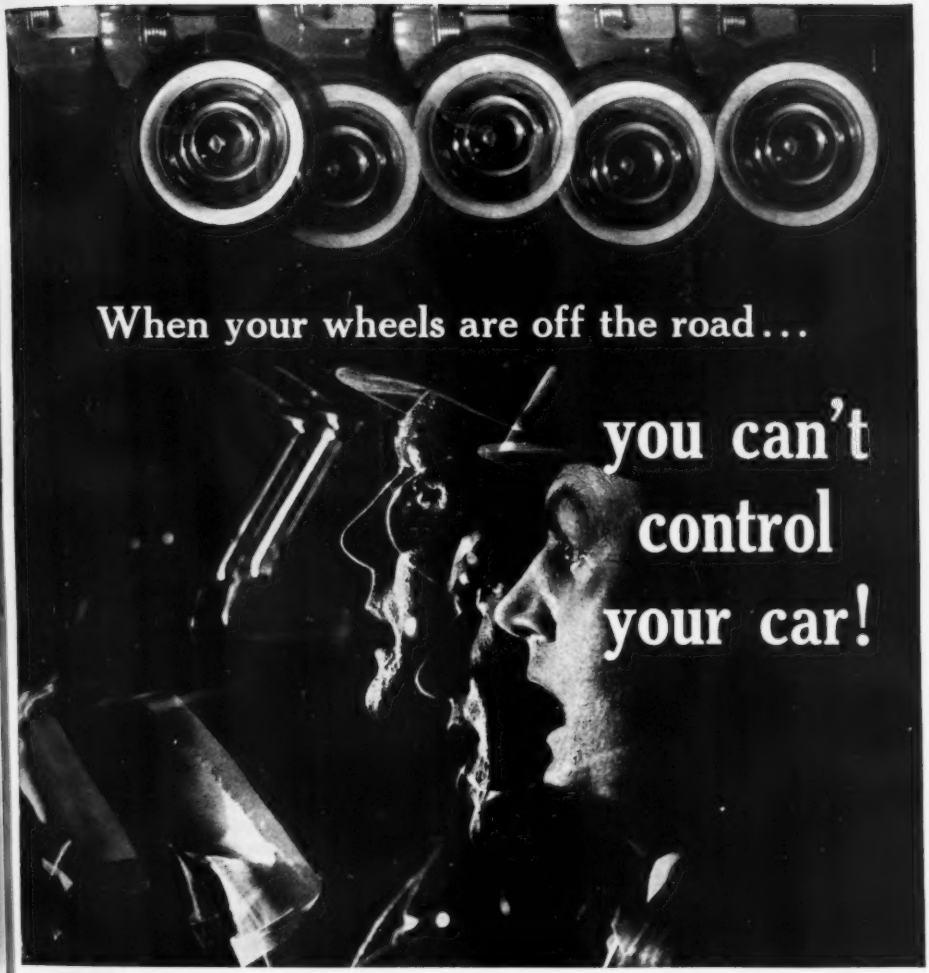



**A pouch for tools** will double the usefulness of a spare-tire cover. Just tack it to a piece of plywood. A clip screwed to the plywood holds it on the wheel. When needed, the cover can be lifted out easily and carried by the clip.

**Car doors take a beating** from masonry walls and it's not easy to nail a protective cushion to concrete or brick. But a sponge-rubber mat cemented over plywood can be *hung* from a single nail driven into a weak spot in the mortar.




**If you drive in rough country,** you need a flexible mount for the license plate on your light truck, jeep, or other vehicle. A piece of a belt used like this will flex if the plate is snagged, keeping it from being torn loose or crumpled.




**You bet your life on your shock absorbers.** Bouncing wheels are a sign of worn shock absorbers . . . and potential danger. When shocks wear out, steering becomes erratic and your car will sway badly on curves. Monro-Matic® shock absorbers do far more than just cushion your ride. They hold your wheels firmly on the road—even when you hit a sizeable bump or rut—to stabilize your car and prevent loss of control. *Play it safe.* If your present shocks have seen more than 20,000 miles service, replace them with Monro-Matic shock absorbers for the ultimate in control, comfort and safety. *60-day free ride plan guarantees you complete satisfaction.*

***LOOK FOR THE YELLOW AND BLUE SAFETY BARREL WITH THE SHOCKS ON TOP!***

MONROE

**MONROE AUTO EQUIPMENT COMPANY** • MONROE, MICHIGAN • In Canada, MONROE-ACME, LTD. Toronto, Ontario • In Mexico, MEX-PAR, Box 28154, Mexico City • World's Largest Maker of Ride Control Products, including **SUPER LOAD LEVELER®** Stabilizing Units

# Gus Pulls the Switch on Murder

**By Martin Bunn**

A SHADOW fell on the starter Gus was working on just inside the Model Garage. He looked up at Silas Barnstable, the town's stingiest motorist.

"Come to pay for the differential-cover gasket you sold me," said Silas.

"Find somebody who'd install it and pour back the same old grease?"

"Yup!" retorted the other triumphantly. "Didn't pay any hijackin' gas-station feller, neither."

"Congratulations," said Gus curtly.

"Talked one into lettin' me use his lift for free!" cackled Barnstable. "Done the job myself. Found out somethin', too."

Gus made no answer, and Silas went on. "Always knew them gas stations put in more grease'n necessary. After I poured back enough to run out the plug hole, there was enough left to last me a couple years, now the leak's fixed."

"That's just fine," said Gus dryly.

"Here's your gasket money—less two-percent discount," finished Silas.

Gus sighed. "It's lunch time, Silas, and I'm too hungry to argue with you."

Returning from lunch, Gus found a powerful three-year-old sedan in the shop. It was loaded with accessories, including two spotlights. Curious, Gus looked inside. Despite its lavish equipment, the car evidently got hard use. Floor mats were gritty, seat covers smudged, visors crammed with papers.

"The man said it's missing or out of time," said Stan Hicks, Gus's assistant. "Sure sounds like it."

Gus started the engine. It shook so hard that the whole car vibrated. He shorted two of the eight plugs at a time. All cylinders were firing.

"Hook up the timing light, Stan," ordered Gus. "Then we'll see."

Stan was reporting that the timing checked out, when a short, stocky, white-haired man strode into the shop.

"Find the trouble?" he asked. "My own mechanics said you were good."

"Not that good," returned Gus. "We need just a bit more time."

The man pulled an old pocket watch

*Gus jumped out of the patrol car and raced back to Gregor's sedan.*

from a checkered vest. "Go ahead. My boys know diesels better than gas engines. I'm Dan Gregor, from the parkway job through Newtown."

Gus recognized the name of an important contractor. "Guess you take this car right on the job, don't you?"

"Where I go, it goes," replied Gregor.

Gus motioned to Stan to get the car on a lift. "Go through much loose rock lately?" he asked Gregor.

The contractor shook his head. "Not till this morning. I parked under a rise and a dozer man almost buried the car before he spotted it."

The car rose. Gus got under it with a light and a tire iron. Presently he came out with something in his hand.

"There's your trouble—this rock wedged in one engine mount. Jammed it solid, so all the give was on the others. Let me take another look."

Gus found no more rocks. In the floor pan just behind the engine were two small holes a few inches apart. They were new—the drilled edges gleamed. Nearby, snaking down from the cowl area, was a length of wire. He wondered what new accessory it might be for.

After the car had sighed down to the floor, Gus started the engine. It idled smoothly. Gregor paid and drove off.

TWO days later, Barnstable's eight-year-old car rolled back in.

"What's wrong, Silas?" asked Gus. "Want your money back for that gasket?"

"Humph! Might be. Got a new noise."

"What does your gas man say?"

"Smart-aleck kid! He thinks it's a dry rear-axle bearing."

Silently Gus got into the car. Barnstable drove around the block to the accompaniment of a dry screech.

"Now," asked Silas, "what is it?"

"A dry rear-axle bearing," said Gus.

With the car on the lift, Gus turned both rear wheels. The left-hand one screeched bitterly. Walking under the car, Gus scraped at the differential cover.

"Didn't bother to clean this off?"

"Dirt outside never done no harm," growled Barnstable. "My time's worth money. Cleaned off all the old gasket and

CONTINUED

drew them bolts up good 'n tight."

"Car make any noises afterwards?"

"Just a couple scrapes. It quit when grease got to the dry spots."

"Come and look, Silas. See if you can't figure why that dirt you didn't scrape off is going to cost you cash."

Puzzled, the town's stingiest man hunched under the lift beside Gus. "It's dry—ain't leaking any more."

"No, but see this bulge in the cover that I scraped clean? That's the cavity your ring gear runs in."

"Fiddleflap!" muttered Barnstable. "It slants. Ring gear runs up and down."

"It slants," agreed Gus, "because you put the cover back one bolt hole clockwise of its proper position. All that caked dirt hid the bulge, so you never noticed. What you heard first was the gear chewing itself a new groove."

Barnstable made a moaning sound.

"Also," Gus went on, "turning the cover one hole lowered the plug hole, so grease flowed out when you'd put back only two-thirds of it. The level was too low to reach the axle bearings."

Barnstable shakily emerged from under the car. "Fix it," he muttered weakly. "But remember, I ain't made of cash."

"Gear's pretty hard," said Gus cheerfully. "Chances are it's not damaged."

"Fix it," mumbled Silas as he left.

Gus found the cover dangerously thin where the gear had scraped it. Grinning, he installed a new one after flushing out the housing. Just as the job was over, a state police car roared in.

"HIYA," called Trooper Jerry Corcoran. "Mind setting my points? She's missing at high speed, and the barracks shop's closing right about now."

"Sure, Jerry," said Gus, and hooked up the dwell meter. "What's new?"

"We're hunting some explosives stolen from the Newtown road job."

"Gregor's? He was in just today."

"Uh-huh. He's a tough old boy. We've caught him carrying dynamite and detonators in his car at the same time, when his powder men ran short. Some day he's going to blow himself up."

"How much is missing?" asked Gus.

"Ten sticks. Couple of electric caps. That's a bad combination. All the men on the job are clear. Only one missing is Gregor's own nephew."

"Maybe he'll have the answer for you when he gets back," suggested Gus.

"Not likely. He walked out after a big scrap with his uncle yesterday. He's kind of wild, doesn't like the discipline old Gregor dishes out."

Gus tightened the points with an eye on the dwell meter, snapped back the distributor cap. "Okay, Jerry."

"Thanks Gus." Jerry got into the car. "Wouldn't think a young chap would run out on a fortune. The timekeeper says he's Gregor's only kin and heir."

"Maybe he swiped the dynamite to go into business for himself," joked Gus. Then his grin faded. "How big a pack is that many sticks?"

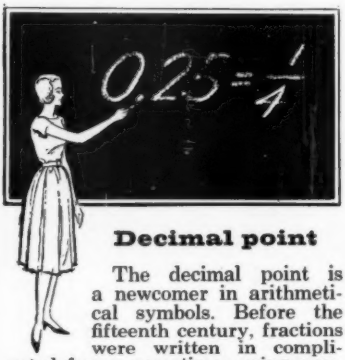
Jerry made a circle of two hands.

"This is crazy," said Gus. "But . . ." Briefly he told of the two holes under Gregor's car and the dangling wire. "With a metal strap and two drive screws, you could fasten something under there."

Corcoran sat silent for two seconds. Then: "Get in, Gus. We're traveling."

Almost before Gus was in it, the car

**Where'd it come from?**




**Decimal point**

The decimal point is a newcomer in arithmetical symbols. Before the fifteenth century, fractions were written in complicated forms, sometimes using powers of 60 as denominators. Thus 14,58',13" meant 14 units plus 58/60 plus 13/3,600. The decimal method (with 10 as the base) was first used about 1620, but with a line drawn under the fractional part of the number. Only in the last 150 years has the decimal point come into general use. In early textbooks, older symbols are used side by side with it. In an arithmetic book published in 1822, 387(65:2 is used to designate an amount of money: $387.65 and 2 mills.



CONTINUED

# you get ACtion with AC

AC SPARK PLUG THE ELECTRONICS DIVISION OF GENERAL MOTORS

## Extend your engine's life with modern lubricants and AC Triple-Trapper Filter ACtion

Today's motor oils are built to give long-lasting protection to modern high compression engines. They have detergents and additives that prevent hard carbon formation, reduce rust and corrosion, inhibit oxidation and work in many other ways to give engines better performance, greater fuel and oil mileage and longer life.

To insure continuing effective lubrication, you need a modern oil filter—an AC Triple-Trapper Oil Filter—to remove the abrasive contaminants that get into your oil. These wear precision parts and help build power-robbing sludge.

AC Triple-Trapper Oil Filters stop particles as small as 1/15 the diameter of a human hair, and they trap the contaminants that form engine-damaging sludge. Most important, *they allow full flow of the detergents and additives that give modern oils their superior protective qualities.* You'll keep your engine clean and powerful by the regular use of premium oil and AC Triple-Trapper Oil Filters. Ask for the best filtering action you can buy, ask for AC.

AC **TRIPLE-TRAPPER OIL FILTERS**

was roaring out. As Corcoran swung onto the highway, he spoke briefly into the mike. A crackling voice answered.

"No phone at the construction site," said Jerry. "A patrol car's on the way to stop Gregor from using his car."

"Hey, now," protested Gus. "That was a crazy-wild guess of mine . . ."

"Could be a good one," retorted the trooper, gripping the wheel harder. It was a cold morning, and the chill seeped in with a 90-mile-per breeze as the car gulped distance.

"Turned real cold," grunted Jerry, switching on the heater. "Your guess may not be so wild. It was young Jeff who tipped us off that his uncle sometimes carried caps *and* dynamite."

Gus said nothing. The car screamed up a short hill, made a hair-raising turn, bucketed along a dirt road onto a scene of raw earth and giant machines. A trooper came over from a patrol car.

"Gregor just drove out. I was too late; but the car must be clean if he could start up and drive off without accident."

Jerry grinned. "Enjoy the ride, Gus?"

"Told you it was a wild guess," muttered Gus. "Never meant—" he paused.

"What is it?" asked Jerry.

"To fake a dynamite accident," said Gus slowly, "I'd hook the cap to the heater. Gregor would turn that on after his engine's warm, two or three miles from here."

Corcoran's jaw snapped shut. He backed the car around on two wheels and tore back to the highway. Gus held his breath as they roared onto the asphalt just ahead of a trailer truck, siren screaming.

Ahead appeared a black sedan. It wasn't Gregor's. The patrol car roared by.

"Two miles right now," said Jerry.

A car appeared, vanished over a hill. "That's it!" said Gus.

CORCORAN bore down on the car, siren wailing.

"Pull alongside so he can see me," suggested Gus, hanging on grimly.

The big V-8 seemed to gather its energy for a spurt, bent out around the other car. Gus gestured urgently, aware of Gregor's startled recognition and of both cars slowing their frantic race. But he never remembered opening the door and running back.

"What the devil?" demanded Gregor, his hand moving almost unconsciously toward a button midway on the dash.

Gus reached in, switched off the ignition—just as Gregor turned on the heater—and snatched out the key.

"You've got a nerve . . ." began Gregor.

"Hold everything," said Gus breathlessly. "The trooper will explain."

Corcoran did, but it was Gus who slid under the car. His heart skipped a beat when he saw the ominous package fastened there, with small cylinders inserted in two of the sticks. He crawled out without touching anything and nodded gravely to Jerry . . .

"Jeff rigged it," Corcoran told Gus that night. "Since we caught the old man hauling caps and dynamite together, we would have put it down as an accident."

Corcoran lit a cigarette thoughtfully. "Our experts found that the heater *had* been turned on. Somebody switched off the ignition a split second before, killing the heater circuit. Pretty cool nerves, Gus."

"Cool?" asked Gus. "They were frozen stiff from riding with the wildest driver in the state police."

*Career-minded Jay C. Douglass of Elizabethtown, Pa., asked...*

# "How should I get started?"

This year some 100,000 ambitious young people will answer this question the same way Jay Douglass did–they will become members of the Air Force. The road they will start upon leads straight into the Aerospace Age. And the organization of which they will become a part is the most important one in our world. For it is our country's first line of defense.

In time to come many of these young men will advance to the role of skilled technicians in such fields as airplane and missile maintenance, communications equipment, computers, radar. A number of these young men will enter the vital support specialties–administration, supply, air police...to name a few. Any one of these career fields holds the promise of a bright and rewarding future–a future *you* should know about in detail right now.

*Getting started in the right job, is important to any young man...or any young woman. To find out if your start might best be made in Air Force blue, clip and mail this coupon.*

## U. S. Air Force

**Airman 2C Douglass** is presently working as an electronics specialist at Duluth Air Base, Minnesota. As Air Force aptitude tests indicated, he finds he can handle his job well. He feels *he has made a good start.*

**Career Information**
**Dept. MPS110, Box 7608**
**Washington 4, D. C.**

*I am a citizen (or resident) of the U.S.A. Please send me your illustrated booklet.*

**Name**_____ **Age**____

**Address**_____

**City**_____ **County**_____ **State**_____

## The 90 Miles of Wire in Your Home

[Continued from page 116]

mill. Squeezed, and then snatched up and reversed before it leaves, the "car" becomes a "train."

Now thin enough to lace around horseshoe curves, it gets a last six squeezes in finishing mills. At the end it's automatically coiled and set on one of the arms of a turnstile.

All this time, the pulpit engineer has watched the bar's progress like a railroad dispatcher. Every control has been preset, but he can override it instantly in an emergency.

In the final act, craneman No. 2 snatches the coils from the turnstile and trundles them to a succession of tanks where they're first pickled in dilute sulfuric acid to rid them of scale, and then dunked in neutralizers and rinses to remove the acid.

***The final stretch.*** A few miles away, in Union, N.J., Continental gives the rods the one-way stretch that turns them into wire.

If soft metals such as copper or aluminum are being drawn, the technique is "wet." The machines—covered for safety reasons—coat the wire and dies with soapy lubricants and coolant so that friction heat won't melt the metal. But steel and other tough alloys are drawn into wire "dry."

At the first stage, copper-rod coils are reduced to heavy wire—usually 18 gauge. Big "breakdown" machines take four coils, welded end to end, and zigzag them through 13 dies of constantly decreasing size.

One thing troubles you. How do you thread a 5/16-inch rod through dies with holes shrinking to .04-inch? You get the answer when a coil runs out and an operator flips back a cover as wide as the door of a two-car garage. Quickly he removes the dies from their holders and lines them up in order. Then he points the end of the next bundle and, with a power winch and pliers, tugs one die after another onto a starting length, like wide-spaced beads. He threads this section around the drawing blocks, replaces the dies in their holders, and fastens the end of the copper to the barrel of a 30-inch receiving reel.

Fully loaded reels are placed on what looks like a giant cook-stove burner. The wire, stress-hardened during drawing, must now be resoftened with heat.

You can go on to smaller machines that reduce 18-gauge wire to gossamer. In the process there are several gimmicks that would have pleased old Rudolph immensely.

One of the slickest has just been developed by the Syncro Machine Co. of Perth Amboy, N.J., an outfit whose name is synonymous with advanced wire-making equipment. Syncro's new rig gobbles up the output of a light wire-drawing machine, first charging it with just enough current to set up a warming resistance. Then, while the wire races through a nonoxidizing steam bath, more juice is poured in to bring the wire to the right temperature for softening.

***Continuous production.*** More and more, wire-drawing and processing machines are being lined up in tandem, for continuous automated production. In a Western Electric plant in Omaha, Nebr., the wire that goes into your dial phone is passed through consoles that draw and tin it, apply plastic insulation colored for coding, and then sheathe bundles in tightly woven fabric.

Still, the only tools that make it possible for you to have 90 miles of wire in your home are the drawing dies. About as big around and three times as thick as a wrist watch, these are disks of steel in which are bedded either tungsten carbide or diamond cores. The holes in the cores are tapered part way through, then straight-walled, and, at the outgoing end, expanded slightly.

The angle of the taper is important. If it's much more than 15 degrees, stresses are far higher at the surface of the wire than at the core, causing what's called cup-and-plug fractures. On the other hand, too small a taper produces intense friction heat.

Rugged as they are, modern dies get out of gauge after about eight hours of continuous use. The holes are then ground to the next-larger gauge size. This can be done as many as 10 or 12 times before they're through. That's fortunate, because a tungsten carbide die for heavy-wire drawing costs from $10 to $15, and a fine-wire diamond die, from $45 to $100. ■■

## Answers to P S Puzzlers

see page 58

**Table tricks:** 1) Wet the string, lay it on the cube, and sprinkle salt along its sides. The salt lowers the freezing point so that the ice melts. It then robs enough heat from the watered string to freeze it to the cube and enable you to lift it.

2) This is the old trick of arranging objects so that their center of gravity is lower than the point of support. Cross the knives, handles downward, through the cup handle and stuff napkins there to hold them. The CG is now below your fingertip.

**Apples.** Pete's apples were ½ cent each, George's ⅓. If they were sold separately, the total amount taken in would have been $\frac{1}{2}n + \frac{1}{3}n$ (where $n$ is the number of apples in each batch). But in selling them at five for two cents, the profit was $\frac{2}{5}n + \frac{2}{5}n$ or $\frac{4}{5}n$. So $\frac{5}{6}n - \frac{4}{5}n = 7$. Multiply both sides of this equation by 30 and you get $n = 210$. George took in exactly $1.68, which was split $.84 and $.84. But Pete should have made $1.05 and George only $.70 (for a proper total of $1.75). So Pete lost 21 cents while George gained 14.

**Canals.** The 50,000 readers all had the right answer: "There is no possible way."

**Lies.** You can break into this circle of logic at any point and eventually arrive at proper conclusions. If you assume A's statement is true, you are immediately led to a contradiction: C's statement becomes true. So you have A both true and not true. If you assume B is telling the truth, then C lies—and this yields interesting results. For the denial of a statement of the form "Both A and B lie" is not that "Both tell the truth." It is an alternative: If not both are lying, then either A is not lying or B is not lying; *at least one tells the truth.* If we let B be that one, we get a proper chain: A's statement is false; B's statement is true; C's statement is false.

**Calculations:** Mentally you probably found the pair 3 and 3½ without any trouble ($3 + 1\frac{1}{2} = 4\frac{1}{2} = 3 \times 3\frac{1}{2}$). To devise a general rule for the infinitely many pairs possible you can use this equation:

$$a + b = ab$$
$$a = ab - b = b(a - 1)$$
$$\frac{a}{a-1} = b$$

Therefore for any number you choose, say $a = 5$, you can calculate $b$ ($b = 5/4$) and you have a pair that works.

To calculate odds: Odds are just probabilities turned around a bit. If they're two to one against Sport, it means he has a one-out-of-three chance of winning. If the odds are three to two, then the chances of winning are two out of five.

Since there are just three horses running in the race, the various probabilities of winning should add to 1: $\frac{1}{3} + \frac{2}{5} + x = 1$. So Blackie's chances of winning are 4 out of 15. The odds against him are then 11 to 4.

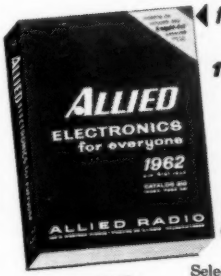

space age hobby

BUILD-YOUR-OWN ELECTRONICS FOR MODERN LIVING

IT'S FUN...IT'S EASY WITH MONEY-SAVING

knight-kits®

A PRODUCT OF ALLIED RADIO



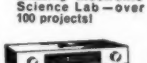

featured in the 444 page

1962 ALLIED ELECTRONICS CATALOG

free send for it!

Dozens of new hobbyist kits, including amazing Electronic Science Lab—over 100 projects!

Select from more than 70 exciting Knight-Kits! See—Stereo hi-fi, including new Multiplex Stereo tuners and all-transistor amplifiers, short-wave radios, intercoms, Citizens Band radios, electronic science labs, test instruments—all easy to build and a pleasure to own! Send today for your FREE 1962 ALLIED Catalog!



Everything in Stereo hi-fi components; new Multiplex Stereo FM tuners

New—tachometer kit and outstanding test instruments

New all-transistor intercom; many other kits for modern living

SAVE ON EVERYTHING IN ELECTRONICS

Get the most for your money in: Stereo hi-fi systems and components • Recorders and tape • Citizens Band radios • Amateur station equipment • TV tubes, antennas, accessories • Electronic parts, tubes, transistors, tools, test instruments, books. Send today for your FREE 444-page 1962 ALLIED catalog!

NO MONEY DOWN
Easiest Terms

FREE CATALOG

ALLIED RADIO

ALLIED RADIO, Dept. 27-K1
100 N. Western Ave., Chicago 80, Ill.

WORLD'S BIGGEST

☐ Rush FREE 1962 ALLIED Catalog

Name_____
PLEASE PRINT

Address_____

City_____ Zone____ State_____

carry the load—each can take 1,000 tons easily. It's that they don't know how that load is distributed. If the space above one jack is hollow, while its neighbors are under solid rock, the disproportionate load might set up dangerous sliding. And the variations due to air spaces or statuary within the temples are not all. The rock itself is temperamental —heterogeneous, soft, and in some places already cracked.

To get around these problems the jacks will advance only one millimeter—about 1/25 inch— at a time. Working in such minute steps, each jack can meet any resistance and automatically adjust its thrust.

Yet not even these precautions are enough to insure that the slab the jacks support will stay perfectly horizontal. Again the danger of setting up elastic or plastic sliding of the foundations makes engineers shudder. Here the solution may lie in the use of interconnecting mercury vessels set on the slab itself to monitor deviations from true. If a variation exceeds a prescribed tolerance (probably one mm.), lights will flash at the control center so an operator can adjust the appropriate jacks.

In this way the pistons will be regulated until they move their full stroke—about a foot. At the same time the new foundation will be put in underneath. When the jacks have finished, the foundation will be cross-linked and strengthened, and the sheltering box frames removed. Then the landscape artists will go to work to restore the setting.

***How long?*** If work on the site begins by May, 1962, experts estimate that the smaller temple might reach the lifting stage by January, 1965, and the larger temple a few months later. Finishing the job, landscaping and all, would take another three years. What would it cost? That, too, is uncertain, but the current guess is about $75 million.

While Egypt will contribute some part of that, the bulk of the money will come through appeals made by the United Nations Educational, Scientific and Cultural Organization. The agency has set up a general fund to save the monuments of Nubia—the name of the ancient kingdom that once dominated the southern Nile. President Kennedy has already asked Congress to pledge $10 million.

***The French dam.*** One thing against the French plan is that it would cost at least $5 million more than the Italian scheme. The Egyptians had first hit upon a dam as a possible solution when they realized that if the temples were to be saved at all, they would have to be saved in place. Rameses had chosen the site so carefully that even were it possible to move the buildings stone by stone to another location, much of their beauty would be lost. In the first place they face east so that the rising sun sets the red diorite rock of the mountain aglow—and even reaches the temples' innermost parts at certain times of the year. Second, the temples face a spectacular part of the Nile. Unlike other rivers of the world, the Nile widens as it nears its source. At Abu Simbel, 175 miles south of Aswan, it is already a broad blue sweep.

So the Egyptians engaged a French firm to design a dam. The plan was superb. The engineers envisioned a dramatic rock-fill structure that would encircle the temples at a distance far enough to preserve the view. (A suggestion to use concrete was ruled out: Such a heavy structure couldn't possibly rest on the alluvial deposits of the Nile's bottom, but would have to reach down to bedrock—and this, too, is poor.) The sides of the dam would slope back and up to a 200-foot crest (almost as high as Aswan itself).

***But would it work?*** No one was sure. No one was sure *any* dam, no matter how faultlessly conceived, could prevent fatal water seepage. So an around-the-clock pumping station was included—with a yearly maintenance bill of $370,000.

Even then there were doubts. Might not the temples be subjected to excessive humidity, surrounded by all that water? Wouldn't there still be danger of water seepage? What if war broke out and the pumping station were abandoned?

But perhaps the real reason for abandoning the dam idea was esthetic: If the dam were built, one of the world's great wonders would face life from the bottom of what amounts to a 200-foot well. Rameses, for one, would never have approved. ■■

# *See it—ride it at your dealer NOW!*

## THE ALL-NEW 250 CC HARLEY-DAVIDSON 1962 *Sprint*

Sprint up to a new class of motorcycling with the all-new 250 cc Harley-Davidson Sprint. Here's a flashy "performer" packed with power, style and spirit!

Slim and distinctive, the Sprint commands attention wherever it streaks — on raceway or highway. Smartly styled in Calypso Red and white. Seats two with ease and perfect comfort.

See your Harley-Davidson dealer now for a spirited demonstration ride. Remember, he's got a convenient payment plan to send you *Sprinting* today! Ar l mail the coupon for colorful literatu

### Check these outstanding Sprint features

**✓ Power** — 15 cu. in. overhead valve engine provides potent 250 cc power package. Has helical primary drive and down-draft carburetion.

**✓ Suspension** — Twin-action suspension smooths out bumps hydraulically. Telescopic front fork and rear swing arm suspension share the load for riding comfort.

**✓ Footrests** — Foldback footrests offer maximum safety. They get out of the way on contact. Rubber-covered for long wear.

**✓ Handlebar Grips** — Handlebar grips are large, more grip-sure to eliminate hand fatigue on long, tough grinds.

**✓ Transmission** — 4-speed integral. Easy-action foot-shift.

**✓ Brakes** — Large diameter front and rear wheel brakes. Fully enclosed and waterproof.

**HARLEY-DAVIDSON MOTOR CO.**
**Dept. PS-10, Milwaukee 1, Wisconsin**

Please send me literature on the all-new Sprint.

Name.....Age.....

Address.....

City.....Zone.....State.....

[Continued from page 84]

a gallop instead of in the usual uniform pattern.

North of Springfield, Ill., on Route 54, we came to a 10-mile speedometer-check zone. The odometer read 5.5 percent high and the speedometer indicated 62.5 m.p.h. at an actual 60.

Next day we pointed straight for the Rockies—across the Mississippi at Hannibal and the Missouri River at St. Jo. We were rolling along the route of the Pony Express on what we later learned was the hottest day of the year. A thermometer in the shade at a roadside service station read 103 degrees. In the sun out on the highway it felt like 120.

The speedometer seldom dropped below the legal 70 m.p.h. But neither speed nor heat produced the faintest protest from the engine compartment.

***Time trials.*** On lonely stretches of road the third day out, I made some acceleration trials. Ralph held the stop watch. The car seemed a bit sluggish getting under way, zipped briskly from 15 to 40, hit a slight flat spot between 40 and 45, then breezed on up to 60. Average time 0-60: 16.5 seconds. Time for last year's V-8 was about 14.2.

"She's a little sick," Ralph said. "We've been making it about 14.9 at the proving grounds." We made several more trials with similar results.

"Let's stop at the first Buick dealer we can find, check the timing, and have a look at a plug," Ralph said.

An hour later we pulled into the Buick dealer's shop in Norton, Kans.

The timing checked out right on the button and the plugs were okay.

Back on the highway we made several more runs in opposite directions to be sure we weren't being fooled by grade or wind. The story was still the same for 0 to 60. For 30 to 50 we timed 7.1 seconds; 50 to 80 was 18.7.

That night in a motel in Colorado Springs we checked our overall gas mileage before tackling the mountains. When we topped off the tank on arrival we had added a quart of oil. In three days of high-speed driving we had averaged 18.9 m.p.g. and that included the fuel-wasting acceleration trials.

***Pikes Peak or bust.*** Early the next morning we were on the road to the top of Pikes Peak. A warning at the tollgate told us the road was open only part way. It had snowed on the Peak during the night, but the snowplows were working. Two-thirds of the way up we had to wait an hour until the road was cleared.

A dense cloud shrouded the top of the Peak. It was cold—23 degrees—and was still snowing.

I pushed the V-6 as hard as I dared, going up. It gave me no back talk. That dull throbbing I kept hearing was my heartbeat when I looked into the emptiness pressing the road to the mountainside—seeming to compress the nominal two-lane road into an impossible single lane.

Coming down, we saw several late-model cars on their way up suffering the effects of the thin air and hard climb. They were parked in turnouts with clouds of steam billowing from open hoods.

For two days we sought out the most rugged driving we could find. Shunning the paved tourist routes when possible, we roamed dirt roads through the mountains from the old Gold Camp Road out of Cripple Creek north to the Rocky Mountain National Park. Although gasoline mileage dropped to 14 m.p.g., the little V-6 shrugged off the worst punishment I could devise.

At highway speeds it seems as smooth and quiet as any six. Acceleration at the low end is scarely spectacular, but it's a brilliant performer in the range of usual passing speeds. I have no reason to doubt Ralph's statement that this particular engine was slightly anemic—it had, in fact, felt livelier to me at the beginning than it did by the time we made the acceleration trials—but even so, it outperformed any of the other standard compact sixes I have driven. Fuel economy was not remarkable but was about what I've learned to expect from a car with this performance. ■■

***Next Month: Hottest freight train in the U.S. is the Boston-Chicago Yankee Jet. Luxury trains stand aside to let her through as she rockets down the tracks to open a new era in high-speed railroading. Hop aboard for a "Record-Breaking Ride on a New Super-Freight"—in November Popular Science.***

*Your New "ONE-TOOL, THREE SPEED" Shop from*

# SHOPMATE®

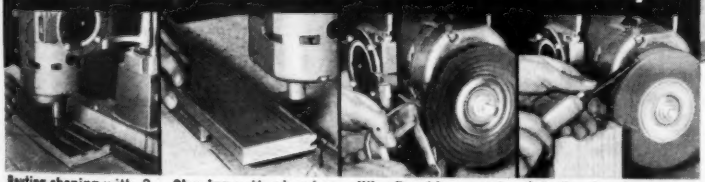
## *FOR MOST ALL YOUR WOODWORKING JOBS*

For carpenter, cabinet-maker or home craftsman – a 2½ H.P. radial arm 10" saw unit with three separate geared spindle shafts with the right speed for each job; 3450, 5000 and 10,000 rpm.

## CUTS *ALL THESE VARIATIONS!*

- Cross Cut 4" x 4", 2" x 12", 1" x 16"!
- Bevel Cut 45°–90° positive stops!
- Rip outboard to center of 4' x 8' panel; inboard to 16¾"!
- Dado ¹³⁄₁₆" wide, up to 1⅞" depth!
- Miter right and left!
- Plus auxiliary power for tools of your choice!

## *Completely Versatile ONE-TOOL Shop!*



**Routing-shaping** with 3-wing cutters—10,000 rpm.

**Shaping** cutter head on saw shaft—5000 rpm.

**Wire Brushing** metal with 3450 rpm spindle.

**Grinding** for sharpening tools, cutlery—3450 rpm.

**Buffing-Polishing** metal or hardwoods at 3450 rpm.

**Disc Sanding** at 5000 rpm.

**$179.50**

**Model SR-800** with switch bar push button lock—locking key for extra safety.

MAIL COUPON NOW FOR FREE DETAILS

**Portable Electric Tools, Inc.** PS-10

1200 East State Street, Geneva, Illinois

Send information on the new Shopmate Model SR-800 10" Integral Radial Arm Saw to:

Name.....

Address.....

City..... Zone..... State.....

Favorite Dealer.....

*Tools with the torque to take it!*

you have to pass quickly, that jerk can be mighty welcome. Upshifts come at around 40 and 75 m.p.h. at full throttle.

For me, the real beauty of this car is its suspension. The torsion-bar setup shared by all Chrysler Corp. products is the finest-handling of any suspension to come out of Detroit. It provides a combination of firm but comfortable ride and sure-footed, no-lean cornering. The ride, unfortunately, has been softened for '62. Spring rate has been reduced and rear roll center raised. Handling has suffered slightly, but it's still topnotch.

Instrumentation is good, except for a decidedly unpleasant horizontal speedo. A little red bar climbs hypnotically up and down five-m.p.h. gradations; when it reaches the top of one it starts all over at the bottom of the next. The only idiot light is an oil-pressure blinker.

The emergency brake is a step-on unit —not ideal, but better than average. Though the new Plymouth is considerably shorter overall than last year's, interior room doesn't seem to suffer. The trunk is immense, but the spare wheel, mounted at an odd angle, takes up more than its share of space. Also, there's that high lip again.

***A sporty Valiant.*** I seem to have picked up all the compacts with bucket seats. The fancy Valiant—the Signet 200—also has the narrow-pleated upholstery on its seats, and once again lateral support is notable for its absence.

Here, as on the Plymouth, ride has been softened, to the slight detriment of handling. Still, in my opinion, this is the best-handling car (together with Lancer, which shares the same suspension) made in Detroit. The small, 170-inch engine is no stormer, but it's more than adequate for everyday driving.

They pulled a dirty trick on us with the shift lever this year. Last year's floor stick has given way to a steering-column job. Although not quite as precise, because of all that extra spaghetti, it does make room for three front-seat riders.

Instrumentation is the best yet: water temperature, alternator, and gas gauges! And blessing of blessings, a circular speedometer. Almost makes up for that oil-pressure light.

The ride is quiet. The trunk is big, as compacts go, but there's that high lip. Steering ranges from moderately slow in manual to quite fast with a power assist.

***Driving the Dart.*** When I started up the engine of the 440, aristocrat of the Dodge Dart line, I was greeted by a soft but authoritative rumble that just sounded too good to be true. A peek under the hood revealed that my luck was holding true: I'd latched onto the big 361-inch engine. The way that engine is crammed in isn't likely to soothe your mechanic's nerves. The spark plugs, for example, can't be reached except from underneath the car. Even then, a set of burned knuckles is sure to result.

Incidentally, that new Chrysler Corp. starter that's supposed to be quieter—sounds *different*, but is still quite loud.

The Dart is a low-slung car, but entry and exit are easy because of the wide doors and low seats. Seats are bench type, with simulated buckets in front. Seating position is comfortable, but a little too low for good forward visibility. Slight distortion is noticeable in the wrap-around windshield. Side and rear visibility are excellent. Instrumentation is similar to Valiant's except for a horizontal speedometer. The offending oil-pressure light is still present.

The proving-ground facilities weren't available for an accurate timed acceleration run, but the car proved remarkably responsive in every speed range and in every gear. Handling, as on the Plymouth, was superb. With power, the steering was a relatively fast 3½ turns lock-to-lock.

Brakes need little pedal effort, and stop the car fast and straight. The emergency brake is a step-on unit.

Best of all, elimination of those '61 wrap-around tail fins makes the Dart look like a car, rather than an overgrown snail. ■ ■

• • • •

Spray 'em on!

JUST PRESS THE BUTTON!

- Clear Plastic Lacquer
- Slide Lubricant
- Degreaser and Cleaner
- Rust Penetrator
- Anti-Rust Oil
- Spray Adhesive
- Brush Softener and Protector

These 7 new Stanley Chemical Tools are quick-easy-clean . . . help you do dozens of jobs faster and better . . . offer push-button ease when working with wood, metal, paper, rubber, leather, etc. For descriptive folder, write: Stanley Tools, 6310 Elm St., New Britain, Conn.

*100% inspected and spray tested*

YOUR CHOICE... ONLY $1.39 EACH

7 NEW CHEMICAL TOOLS from

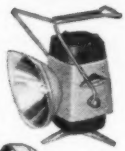
STANLEY®

THE TOOL BOX OF THE WORLD

NOW ON SALE AT YOUR HARDWARE DEALER'S

There's a Delta Lantern RIGHT for You!

**POWERlite** The all-time favorite! Modern new lens, rotary switch. Wide floodlight from top. Brilliant spotlight.....$6.15



**STARFIRE** Rotary switch operates powerful spot beam and flashing red light. Hang it or set on the handle—point the light where it's needed.....$7.95

**ASTROlite** Flashing red light pivots on arm. Piercing spotlight. Adjustable head. Dual fingertip switches. Mounts on twin-pack battery. From.....$7.95

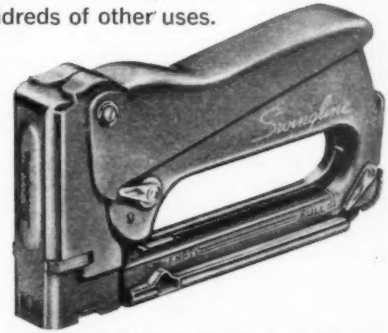
Only Delta has sixteen beautiful electric lanterns—each with advantages for different uses. There's a lantern with features and design suited to your needs. Prices begin as low as $1.79. See the Deltas at your dealer's, or write for literature and Free Fishin' Calendar.

*Prices list, less 6-volt batteries.*

Delta LIGHTS THE WAY

DELTA ELECTRIC COMPANY, 325 W. 33rd Street, Marion, Ind.

screens, upholstery, carpets...
hundreds of other uses.




*Swingline 101 Staple Gun*

Staples practically anything. Exclusive push-button loading and built-in staple extractor. At your stationery, department or hardware store.

*only* 4.95

FREE: *New 8-page* "TIPS FOR TACKING" Booklet

shows you how to save time, money and effort—with a Swingline Automatic Staple gun. Send for yours today!

tips FOR TACKING

Swingline INC.

32-00 Skillman Ave., Long Island City 1, New York

NOW SAVE $66.45

Limited time only at your DEWALT dealer's

Here's your chance to own

# DEWALT

## 33-PIECE

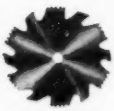
the greatest "*DOUBLE VALUE*" ever offered!

# POWER SHOP plus CHEST FULL O' TOOLS

Plywood Saw

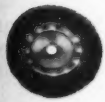
Tool Guard

Dado Knives


Dado Cutters

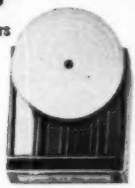
Cup Wheel

192-Page Book


Wire Wheel

Sander Disc

Boring Bit Set


Buffer-Polisher

Shaper Cutters
Drum Sander

1 DEWALT MODEL 925 DELUXE with all these exclusive features: (1) Wedge-line styling. (2) Eye-ease green color. Color-coded controls. (3) Totally-enclosed motor delivers over 2 H.P. Dual-arbor motor shaft permits use of low-cost right-hand tools. (4) Built-in motor brake stops saw instantly. (5) Safety key switch. (6) Drop-leaf safety table. (7) Cut-off scale on fence. (8) Big capacity—9" saw cuts 2½" deep, rips 48" panels in half. PLUS MANY OTHER BIG FEATURES.

2 CUSTOM-MADE STEEL CHEST complete with select tools—33 pieces in all—and all are genuine DEWALT brands that shopwise men use for quality work. Chest is also available with your purchase of other new 9" and 10" DeWalt models.

Buy this great combination—DEWALT plus CHEST FULL O' TOOLS and SAVE BIG $66.45. Hurry to your DeWalt dealer and take home the biggest buy ever.

DEWALT, INC., Dept. PS-1061
A *Black & Decker* SUBSIDIARY
Lancaster, Pa.

☐ Send me special Chest Full O' Tools information.
☐ Send name of nearest dealer.

Name_____
Address_____
City_____ State_____

# NEW WINEGARD
## TRANSISTORIZED
# ANTENNA INVENTION

## ELECTRONIC POWERTRON TV Antenna gets amazing reception distance, clears up snow and interference

Now an antenna has been invented that makes an instantaneous improvement in your TV reception. The transistorized amplifier built into the antenna makes the new gold anodized Winegard Powertron 5 TIMES MORE POWERFUL than ordinary antennas. Imagine the difference when TV signals are magnified more than 5 times.

***Your TV reception improves instantly!***

You'll get clear, sharp pictures, black and white or color. Snow and interference are virtually eliminated. You'll pull in stations ordinary antennas can't reach.

***Get the ultimate in TV reception!***

Have your TV service dealer install a Winegard Powertron today . . . only $74.95—Super Powertron $104.95. Write for free detailed brochure.

**Winegard**
3021-10 Kirkwood, Burlington, Iowa


### *The Story of the GIs' Old Flame*

[*Continued from page 108*]

to see how Zippos are made, the Bradford plant is open for inspection. Or almost open—106 out of 108 separate operations are on display. The missing two are company secrets—literally kept behind guarded doors. These operations govern the knurling of the flint wheel, the heart of the lighter. Their development alone cost $300,000. One executive who'd been with the company four years confessed that he hadn't yet seen the inside of those rooms.

Technically the material used for flints is a "pyrophoric iron-cerium alloy." Cerium, an element of the rare-earth group, is combined with iron, copper, and magnesium, and poured molten into thin metal tubes in a foundry.

The more iron used, the cheaper the flint and the harder: It sparks poorly and ruins the wheel. If too little iron is used, you get a big spark, but the flint gums up the wheel because it's too soft.

The visible stages of production start with the squeezing of long rolls of sheet brass to make Zippo tops and bottoms. Then follow the annealing, welding, and electronic soldering processes; the buffing, polishing, and re-buffing; the plating stages. The final assembly includes inserting the flint wheel, cam and cam spring, flint and flint-spring unit, and the wick, cotton balls, and felt bottom pad. Girls then hand-fit the tops and test each lighter before it's packaged.

***One-day service.*** Under its sweeping guarantee, about 2,000 Zippo lighters are turned in every day for repair. The process is simple. A code number is attached to each lighter and it's passed down a line of girls in the Repair Clinic. One opens the case, removes the "insert"—the guts of the lighter—and throws it away. She then either rewelds the hinge to the case or installs a new one. The next girl puts in a new insert and hands it on to another girl who packages it to send back.

Blaisdell makes it a point to visit this department several times a day, to make sure that lighters are on their way home within 24 hours—"so the lighter habit won't be broken."

One Zippo owner returned his lighter in perfect working order. He claimed it was too heavy. Blaisdell returned it with

CONTINUED

his personal check for $3.50 and a note which said in part, "Keep the lighter with my compliments. Suggest you give it to one of your stronger friends."

While Zippo's earnings have never been revealed (it's a closed corporation owned by Blaisdell and two married daughters), the payroll gives some idea: The plant's 500-plus workers take home $2 million a year. Part of that goes to a 12-man art department that whips up designs for the 70,000 clients who give Zippos away emblazoned with their corporate message. For really showy gifts, the company makes a line of 14-carat-gold models at $175 each. But anyone can flash a lighter with that individual touch, too: The company will inscribe a personal signature on your Zippo for just a dollar.

What model does Blaisdell himself favor? The question is academic. The man whose product has probably lit more cigarettes, cigars, and pipes than any other mechanical device in history had to quit smoking 15 years ago. ■ ■


*The proof is in the puffing!*

**PRINCE ALBERT has the flavor most favored in the U.S.A.**

- always tastes fresh
- mild, mellow flavor
- cool 'n' steady burning

**PRINCE ALBERT**

R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

*In Time for Christmas Gift Giving*

**A New Precision Instrument for Leveling and Incline Measurement**

HOPPY

SPLIT IMAGE TRANSIT

Only $9.95

Optional—for the thousands of Hoppy Transits now in use—sturdy carrying case $3.95

**Accurate, Inexpensive, Simple to Operate**

*Easy as a camera to operate! One man—ALONE—can do leveling and incline measuring. Accurate to a fraction of an inch. Many uses on the job and around the house. Guaranteed Product Satisfaction*

| | | |
|---|---|---|
| Carpentry Leveling | Contour Plowing | Guttering |
| Patio & Terracing | Brick Laying | Drainage |
| Duct Installation | Yard Grading | Masonry |
| Foundation Work | Irrigation | ETC. |

If not available at your Building Supply or Hardware Dealer, write directly to:

**HOPKINS MANUFACTURING CORP.**

Dept. S Emporia, Kansas

*Another Quality Product by HOPPY*

### What's New Under the Hood

[Continued from page 77]

Ford's Falcon, the car most insistently publicized as economical, has crept up from 85 to 90 hp. That may cost no extra gas, but a numerically higher axle ratio, adopted for performance, does. Plymouth's Valiant, announced in '59 at 101 hp., in '61 beckoned the motorist to a 140-hp. optional engine, borrowed from Dodge's Lancer.

The compression ratios on Studebaker's six and V-8 have been dropped slightly, but with no power penalty.

***Under big hoods.*** What is happening to compact-car horsepower is as nothing to what is erupting under the hoods of the standard-size cars. Want 409 hp. in a standard Chevy with an engine that revs up to 6,000 r.p.m.? Just ask.

A new Chevrolet 327-inch engine, basically the regular 283-incher restroked and bored out, has a 10.5:1 compression ratio—and 11.25:1 on two high-performance Corvette versions. The passenger-car 327-inch engine with a conventional four-barrel carburetor develops 250 hp. at 4,400 r.p.m. The same engine, with a larger four-barrel carburetor, develops 300 hp. at 5,000.

These two engines also are available in the Corvette, with additional variations. The large carburetor and an 11.25:1 compression ratio deliver 340 hp. The same compression ratio with fuel injection delivers 360, an astonishing 1.1 hp. per cubic inch.

All this, mind you, from that basic 283-inch-block V-8 that carries a rating of 170 hp.

Full-size Chevrolets can also be equipped with a 409-inch V-8. With an outsize, four-barrel carburetor, it develops 380 hp., and with twin four-barrels, 409.

Oldsmobile's top power is up 15 horses to 340, Dodge's up 40 to 305. Chrysler's biggest tops off at 405 hp.

The snootier versions of the Pontiac, Ford, Imperial, Lincoln, and Cadillac are content, for 1962, with these measly horsepowers, respectively: 348, 375, 375, 300, and 325.

With the exception of the new, rebored Chevrolet engine, most of the performance increases result from fiddling with compression ratios, camshafts, carburetors, and intake manifolding. ■ ■

*Get the aluminum furnace filter that* **EVEN REMOVES ODORS!**

**RP® EZ KLEEN®** *the air filter with everything*

*gives you all this*

★ WASHABLE ★ REMOVES DUST, DIRT, POLLEN
★ REMOVES ODORS ★ RETARDS BACTERIA ★ ALUMINUM
★ CONVENIENT ★ EFFICIENT ★ LASTS FOR YEARS

There is a difference in AIR FILTERS

*Send for free booklet*—complete information on what to look for in an air filter.

**RESEARCH PRODUCTS** Corporation Dept. 230-J, Madison 1, Wis. • IN CANADA: Hicks-Baker Ltd., Winnipeg • Spall-Bowman Ltd., Guelph

---

# *Painting?*

**DO A BETTER JOB FASTER**
**Prepare surfaces with Wil-Bond**

This unique liquid, applied with a rag, removes all dirt and grease. Also dulls glossy, varnished or enamelled surfaces. Paint or enamel goes on smoothly and bonds tightly —no unsightly streaks.

At paint and hardware stores.

**Send 25¢ for illustrated Refinishing Manual**
Write for free Wil-Bond folder

Wilson-Imperial Co., 121 Chestnut St., Newark 5, N. J.

## WIL-BOND

---

**DRAINS** cellars, cisterns, wash tubs; **IRRIGATES - CIRCULATES - SPRAYS**

**1,001 uses.** Stainless shaft. Won't rust or clog! Uses 1/6 HP motor or larger . . . ¾ HP for up to 2,400 GPH; 450 GPH 80' high; or 1800 GPH from 25' well. 1" inlet; ¾" outlet. Coupling included free.

**Heavy Duty Ball-Bearing Pump.** Up to 5,200 GPH. 1½" inlet; 1" outlet.

*Postpaid if cash with order. Also other sizes, types.*

**MONEY BACK GUARANTEE.**

LABAWCO PUMPS, Belle Mead 3, N. J.

CELLAR DRAINER
**'Low Boy' KIT**

**$12.95** (less motor)

"High Boy"—22" high. 8,000 GPH

**$15.95** (less motor)

---

***Mail coupon for***

**FREE**

***Electronics CATALOG from Radio Shack***

**Biggest, best ever! More than 100,000 items! 336 pgs.**

**Latest in Stereo, Hi-Fi, Ham Radio, Tapes, Records, Kits! Send coupon—receive big 1962 book plus all issues for one year.**

RADIO SHACK Corp. Dept. 61K4B
730 Commonwealth Ave., Boston 17, Mass.
Send me Radio Shack's electronics catalogs for 1 full year—all free and postpaid.

Name_____

Address_____

City_____ Zone____ State_____

**RADIO SHACK**
Boston, Mass.

---

## BUILD YOUR WORKSHOP LIBRARY

Seven handsome hard cover books, 120 pages each, tell and show you with photos and drawings how to get the most out of your: CIRCULAR SAW & JOINTER, DRILL PRESS, LATHE, ABRASIVE TOOLS, BAND SAW AND SCROLL SAW, SHAPER and RADIAL SAW. Your choice—$1.00 each. Mail check or money order to Deltacraft Books, Rockwell Manufacturing Company, 504K N. Lexington Ave., Pittsburgh 8, Pa.

---

Trindl
"THE MASTER" ARC WELDERS

FREE
Write for Details and Easy Pay Plan

## WELD FOR PLEASURE OR PROFIT
## TRINDL INDUSTRIAL ARC WELDER

Own a Trindl 125 Amp Industrial Welder at less than smaller machines. Welds metals to ¼" thick. Operates off properly wired 110 or 220 volt line. 16 heat stages from 20 to 125 amps. Make, repair anything of metal in the home, garage, farm or shop. No experience or training needed. Full "do-it-yourself" instructions. Guaranteed 12 months in continuous operation. Complete only $98.50 FOB or write for details on 125A and other Heavy Duty Trindl Welders. Dealer Inquiries Invited.

**Trindl Products, Ltd.,** Dept. T3-K, 1807 S. Clark St., Chicago 16, Ill.

For safe handling
and smooth riding
even under tough going...

**BRIGGS**

**IMPERIAL ADJUSTABLE SHOCK ABSORBERS**

For sure control in driving and greater comfort in riding, replace your present shock absorbers with Briggs Imperial Adjustables. The adjustable feature means they can be adjusted to the needs of your car. Ask for Briggs Imperial Adjustable Shock Absorbers by name.

**BRIGGS**

The Briggs Shock Absorber Co.
Cleveland, Ohio

NAPA

### *Alpine Snow Will Boil English Eggs*

[*Continued from page 99*]

Although rarely used in modern power transmission, direct current is more efficient than AC for long underwater cables. It requires only two cables as against three for three-phase AC. Insulation can be lighter and the conductor smaller since a given-size wire will carry about one-third more DC than AC. The use of a DC link also avoids the problem of keeping the two independent AC networks exactly synchronized. Now that the entire job of converting large amounts of high-voltage power from AC to DC and back to AC can be done electronically, the advantages of using a DC link far outweigh the added cost of the conversion stations on each coast.

***Thick and heavy.*** Designed to carry 800 amps at 200,000 volts, each cable has a ¾-inch copper-wire core. Insulation and armor beef up the cable, bringing the diameter to 3 inches and the weight to 19 pounds a foot.

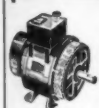
The 30-mile underwater part of the cable was laid in twin 15-mile lengths and spliced together in the middle of the Channel. Frogmen, astride midget submarines, observed and photographed the laying to insure that cables were no more than a yard apart on the bottom. This was to prevent their magnetic fields from deflecting the compasses of ships passing above.

Four miles of buried cable join the land ends to the conversion stations at Lydd on the English side and Boulogne on the French. Of Swedish design, these use ultrahigh-voltage mercury-arc triodes. When exporting power, they act as rectifiers to change the AC to DC. When importing, the same tubes act as inverters, working electronically. The change-over can be instantaneous and needs no elaborate switch gear. A control voltage from the local 50-cycle AC is applied to the grids of the tubes on the receiving end. This causes an alternating output from the tubes that exactly meshes with the AC in the local network.

Giant watt-hour meters on each side of the Channel will keep track of the amount of power each country imports. It is expected that the two-way flow will balance at the end of the accounting year, and only goodwill—not money—will be exchanged. ■■

# SURPLUS SALE

GOVT. SURPLUS EXCESS INVENTORY BANKRUPT STOCK



### ARMY AC GENERATOR

● **Item #626.** Brand new, original crate, all ball bearing DeLuxe heavy duty 115-v 3,000 to 4,000-w, 60-c generator. 1,200 RPM. With voltage control and voltmeter panel, etc.

● Drive with tractor, old auto engine, etc. Ready to use. Great emergency unit for farm, etc. Size 21"x14"x20". Wt. 260 lbs. Govt. cost over $600. SALE **$139.50** FOB

● *A four star buy—1½ units available.*

### Hydraulic Pump and Cylinder Outfit

● **Item #923.** Govt. hydraulic hand pump, reservoir and powerful 2½" bore 7" stroke cylinder with locking ratchet and hose. Pump will handle pressure to 5 ton. Cyl. size 14" extends to 21". Make arbor press, body jack, contractor tool, etc. Wt. 55 lbs. Govt. cost over $75.

SALE ..... **$27.95** FOB

### GOVT. SURPLUS A-C POWER PLANT BUYS

● $275 1-cyl. 1500-w 115-v Air/c..... $182.50
● $600 Onan 2-cyl. 3KW 115-v water/c $219.50
● $1150 4-cyl. 5KW 115/230-v water/c $449.50
● $2250 4-cyl. 10KW 115/230-v water/c $599.50

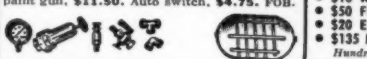
### AIR COMPRESSOR BARGAINS

For painting, cleaning, tires, control termites. Assemble your own outfit. Lowest prices in U.S.

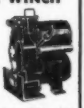
● DELUXE KIT. Compressor, tank, gauge, regulator, paint gun, fittings. How to build instructions. List $52.

SALE ..... **$49.50** FOB

● Compressor 1-cyl. **$21.50.** 2-cyl. **$54.75.** Govt. Air Tank. **$10.95.** Regulators. **$3.95.** Pop Off **$1.75.** Pres. Gauge **$4.75.** Finest paint gun, **$11.50.** Auto switch, **$4.75.** FOB.



### BATTERY REMOTE CONTROL WINCH



● **Item #322.** Powerful Govt. DC hoist with "up-down-off" push-button control switch, 20' cable.

● 35' 4000-lb. hi-strength super-flexible steel cable on self leveling pre-grooved high-strength 5"x6" drum. Winch rating 1000-lbs. on 15-v, 1500 lbs. on 24-v. Fine for boats, loading docks, trucks, jeeps, garages, farms, etc. Easy to install. Electric automatic locking brake. Works off any car-truck 12-v battery. Wt. 90 lbs. Size 12"x14"x8".

SALE ..... **$68.25** FOB

### SELF PRIMING WATER PUMP

● **Item #204.** New Govt. units. Fine for boat pumping, pump, etc. Timken bearings, 1½" intake and discharge ports, ¾" shaft. Size 12"x10"x18". Wt. 32 lbs. Cost $97.50.

SALE ..... **$19.49** FOB

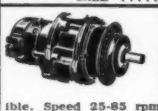
### CONTRACTORS LEVEL-TRANSIT

● **Item #823.** Leading make brand new latest model level-transit with tip-pod and case. Used by leading builders, schools, etc. 18-X scope, high accuracy use as level or transit. Limited time offer ..... **$77.59** FOB

### Hydraulic Speed Reducer

● **Item #1304.** 1 hp variable speed hydraulic transmission. Variable speed 0 to 350 rpm. Instantly reversible. Ideal for lathes, midget cars, etc. Roller bearings, and complete with 3-phase 220-v AC ball bearing motor. Size 21"x9"x20". Wt. 200 lbs. Shaft fitted with pulley (specify diameter desired.) Govt. cost over $900.

SALE ..... **$89.50** FOB



### GOVT. GEARED BATTERY MOTOR

● **Item #569.** Powerful geared-down motor. Runs on 6 or 12-v. Use for golf cart, boat, farm winch, etc. Reversible. Speed 25-85 rpm. Wt. 35 lbs. Govt. cost $250.

SALE ..... **$21.79** FOB

● *Our most popular item.*

## SPECIAL OF THE MONTH!

### LOUDSPEAKING DIAL TELEPHONE

● **Item #740.** Consists of special colored dial phone, desk loudspeaker, and 110-v AC amplifier unit. Speaker and phone set on desk—amplifier under desk. Connects to any dial phone line.

● Talk and listen loud and clear without touching handset. Wonderful on long distance or local calls. Executives can monitor on loudspeaker other conversations on same line. Furnished in jade green or beige. Very attractive and modern. Wt. 25 lbs. Cost over $130.

SALE ..... **$59.50** FOB

### MISC. ELECTRONIC BARGAINS

| | |
|---|---|
| ● $20 Govt. Geiger Tube | .69 FOB |
| ● $6.50 Photo Electric Cell | 1.29 FOB |
| ● $7.25 Dual Thermister | 1.21 FOB |
| ● $90 110-v A-C Selsyns, Pr. | 6.95 FOB |
| ● $6.95 Laboratory Solenoid | .79 FOB |
| ● $5.50 110-v A-C Relay DPST | 1.49 FOB |
| ● 8.25 Giant 110-v A-C Solenoid | 2.98 FOB |
| ● $15 Elec. Massage Vibrator 110-v | $7.69 FOB |
| ● $10 Fish and Worm Shocker 110-v | 3.49 FOB |
| ● $90 Automatic Phone Switch | 12.91 FOB |
| ● $10 W.E. Phone Handset | 3.35 FOB |
| ● $50 Fire-Burglar Alarm System | 12.95 FOB |
| ● $20 Electro-Mag. Veeder Counter | 4.67 FOB |
| ● $135 Mobile 12-v P.A. Amplifier | 9.79 FOB |

*Hundreds electronic bargains in catalog.*

### DIAL PHONE

● **Item #716.** W.E. phone, same type used in telephone offices. Use as extension or main line phone. Set up your own private system. Wt. 8 lbs. Black ..... **$7.95**

Color (specify) Coral, Yellow, Lt. Green, Buff ..... **$11.95** FOB

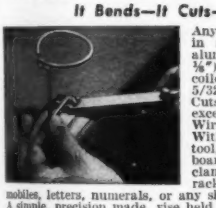
**1962 CAT. ALOG** Electronics, Tools, Binoculars, Hydraulics, Plants, Compressors, etc. New 1962 cat. now ready (send dime or stamps).

**SURPLUS CENTER** LINCOLN, NEBR. DEPT. 832

# WIREFORMER

Works Wonders with Wire

*It Bends—It Cuts—It Straightens*



Any wire, any size up to 5/32" dia. in any metal—mild steel, copper, aluminum, etc. (piano wire up to ¼"). This includes coathangers, coiled or straight wire, including 5/32" cold rolled rod.

Cuts cleanly and neatly, any wire except spring steel or piano wire. Wireformer will also straighten wire. With these combined features in one tool, you can make your own pegboard hooks, all types of hangers, clamps, handles, braces, chains, racks, shelf and equipment brackets, mobiles, letters, numerals, or any shape you want.

A simple, precision made, vise held tool of innumerable uses. Forms in eye of 3/16" inside diameter (just right for any nail, screw, or bolt up to that size). No pliers needed. Wireformer does the work with the pressure of one finger. Straightens the wire if you make a mistake. Cuts the wire just where you want it. Fits in your pocket. Case hardened, plated, with a plastic handle. Forms any angle, arc, or circle. Bends both right and left. Opens a whole new field of endeavor for anyone who makes or fixes things. Wireformer is a tool a woman or a child can use, and it's safe. You need a vise, but the dime-store variety will do. You have never seen anything like it before. We guarantee you'll love it, or your money back. Very complete instructions for precision forming, (fully illustrated), special adapter for small size wire, and brochure showing many things you can make included. Wireformer is the most useful tool you can buy for your home, shop, cottage, farm, factory, garage, studio, or wotavu. As a gift, it's sure to please. Three dollar bills will get you one. Otherwise send check or money order for just..... **$2.98**

We pay postage in U.S.A. Foreign countries $3.50 via 1st class mail.

**ORDER WIRE DIRECT FROM LARGE STOCK**

**IMMEDIATE DELIVERY**

9 ga. (.148" dia.) galvanized steel wire. 24 pieces each 24" long. $1.95 ppd.

5/32" dia. (.156") hardened aluminum wire. Bright finish. 20 pcs. 24" long. $2.25 postpaid.

Sorry, no wire to foreign countries.

**SPECIAL ONE-TIME OFFER (save 43c)**

| | |
|---|---|
| 1 Wireformer | $2.98 |
| 1 package galvanized steel wire | 1.95 |
| 1 package aluminum wire | 2.25 |
| | $7.18 |

**all for $6.75** limited time only

Same with 2 Wireformers $9.50 (save 66c)

**VINKEMULDER MFG. CO.**

**911 Princeton S.E., Grand Rapids 6, Michigan**

# paint anything with JET-DRI

(Made with CCR-37)

## DRIES IN 15 MINUTES

***with superior ...***

- **abrasion resistance**
- **acid, alkali, alcohol resistance**
- **exterior durability**

Greatest advance in paint history! Paint anything... concrete, metal, wood or plaster with no effort, leaves no brush marks... and dries to a porcelain-like finish in 15 minutes. Perfect for indoors and outdoors. Non-toxic. Also Rust-Resistant Primer.

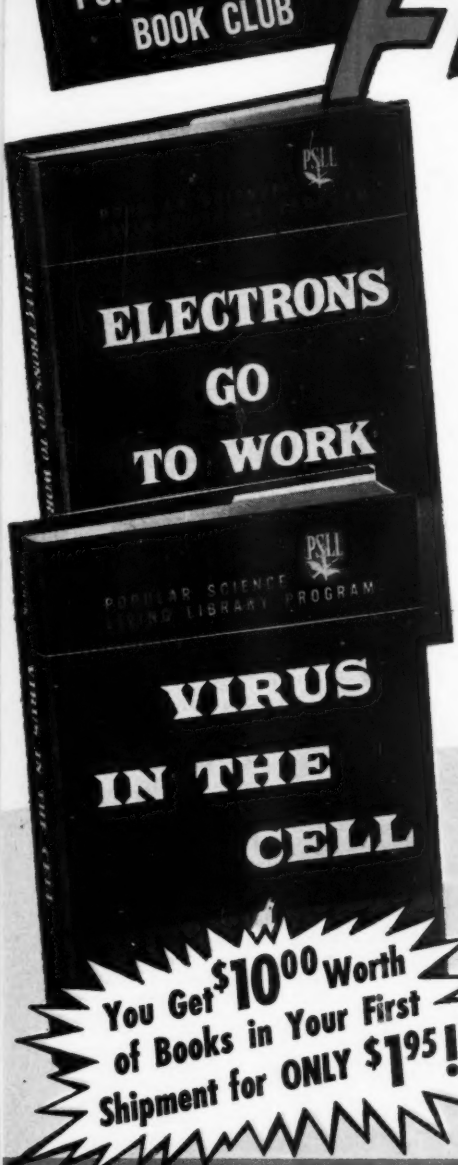
***Wherever paint is sold***

**CONSOLIDATED CHEMICAL & PAINT CORPORATION**

**456 Driggs Ave., Brooklyn 11, N. Y.**

Announcing A New POPULAR SCIENCE BOOK CLUB

# Get These TWO FREE with as a Joining Member POPULAR SCIENCE




Here is a completely new kind of book club, created especially for POPULAR SCIENCE readers! This exciting book program makes it simple for you to build an ever-growing library of fact-filled, easy-to-understand science books at tremendous savings. In these exciting books you'll explore every aspect of modern science — from the invisible atom to the complex human machine to the vast solar system.

By joining the POPULAR SCIENCE LIVING LIBRARY PROGRAM *now*, you immediately get two free selections: ELECTRONS GO TO WORK and VIRUS IN THE CELL. With these two free books comes your first regular selection, THE HUMAN BRAIN. Your bill for *all* three books ($10.00 in bookstores!) will be a mere $1.95! After this first shipment, you receive a new, exciting LIVING LIBRARY selection every three months—at a *guaranteed* low price of only $1.95. That comes to barely 2¢ a day! Yes, for mere pennies you get superb science books that are handsomely printed and illustrated, clothbound in a variety of attractive colors, all in

## YOU'RE OFF TO AN EXCITING START WITH YOUR FASCINATING FREE BOOKS!

Each is a gem of popularized science writing — exciting, colorful, authoritative, well illustrated and packed with facts!

**ELECTRONS GO TO WORK.** The mysteries of matter! From the fiercely-guarded secrets of ancient Egypt to the unfolding of today's atomic theory, you'll follow the dramatic search for answers to these mysteries of matter. You'll learn of the fascinating role of the electron in radio, TV, radar; see how modern electronics can cook foods, harden plastics, count crowds, even sort oranges! You'll plunge into the world of the realistic future, with its amazing automation and its brain-challenging electronic computers.

**VIRUS IN THE CELL.** This exciting book raises the curtain on one of today's great laboratory dramas of science against disease! This is the intensely exciting story of the struggle to understand and control the mysterious sub-microscopic viruses. You'll discover what happens when viruses attack humans, animals, insects, plants; learn the difference between germs and viruses; follow the thrilling victories over smallpox, yellow fever, polio; watch the exciting advances made toward conquest of the common cold; see actual photos of viruses taken through the electron microscope.

You Get $10.00 Worth of Books in Your First Shipment for ONLY $1.95!

POPULAR SCIENCE LIVING LIBRARY PROGRAM
P.O. Box No. 3331, Grand Central Station
New York 17, New York

MAIL CARD TODAY — BUILD A VALUABLE

# GREAT SCIENCE BOOKS First Selection at ONLY $1.95

total valu $10.00

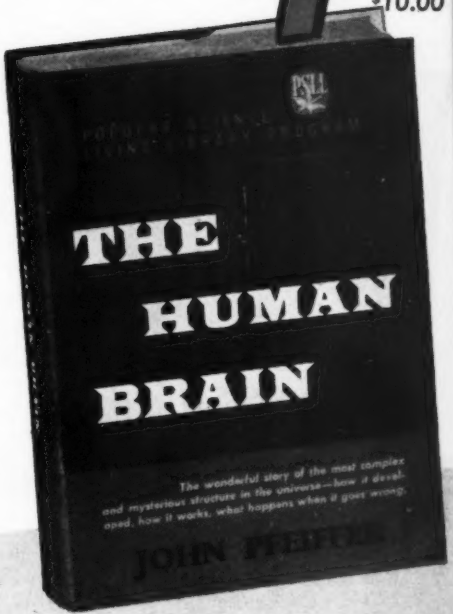
## of the Brand-New LIVING LIBRARY PROGRAM!

matching format. This amazingly low price for cloth books (less than the present-day cost of many *paperbound* books) is made possible by the great economies in enormous printings.

You'll be delighted to find, as your LIVING LIBRARY grows, that your enjoyment and knowledge of modern science have deepened, that you have at your fingertips a ready grasp of many subjects which may have baffled you before, that you can easily answer so many questions your friends and family ask.

POPULAR SCIENCE LIVING LIBRARY books are never priced higher than $1.95 (plus postage) even though bookstore prices are much higher. You never pay in advance. We bill you later. All selections are fully returnable within 10 days. And, of course, you may quit the PROGRAM at any time by simply dropping us a line.

So, get on the road to the best science reading at the lowest possible prices, without risk! Mail the attached post-free card TODAY!


PSLL
THE HUMAN BRAIN
The wonderful story of the most complex and mysterious structure in the universe—how it developed, how it works, what happens when it goes wrong.
JOHN PFEIFFER

**THE HUMAN BRAIN** (Your first selection, only $1.95). The most complex structure we know in the universe is a three-pound pinkish-gray mass, about the size of a softball — the human brain. And here, in a fascinating book, is everything we know about this amazing organ. What is memory? What is pain? How do we think? What are dreams? What is mental illness? All these questions and many more are answered in this fact-filled book. Everything highlighted with true anecdotes and fascinating case histories.

## YOUR FUTURE BOOKS WILL COVER OTHER THRILLING SCIENCE SUBJECTS!

New books in the POPULAR SCIENCE LIVING LIBRARY PROGRAM will cover such fascinating subjects as the living drama of medicine . . . the amazing world of animals and nature . . . the development of power from windmill to nuclear reactor . . . the conquest of space . . . the fantastic workings of the human body . . . the teeming life in the soil beneath our feet and much, much more! Drawing upon the riches of chemistry, biology, botany, archeology, atomic science, zoology, physics, meteorology, and all the other fascinating branches of science, the LIVING LIBRARY PROGRAM will bring you books that are masterpieces of simplicity and readability! Each one will be a valuable addition to your growing, comprehensive home science library!

## CHECK THE MANY MEMBERSHIP ADVANTAGES IN THIS EXCITING NEW PROGRAM!

- ✓ GET TWO FREE BOOKS IMMEDIATELY. *Electrons Go To Work* and *Virus in the Cell* are yours free along with your first selection, *The Human Brain*.
- ✓ FIXED LOW PRICE TO MEMBERS FOR EVERY BOOK. All LIVING LIBRARY books are priced at only $1.95, regardless of higher bookstore prices.
- ✓ FREE 10-DAY EXAMINATION OF EVERY SELECTION. You *alone* decide whether you want the book or not. Books are always returnable, with no obligation.
- ✓ YOU NEVER PAY FOR A BOOK UNTIL AFTER YOU'VE READ IT. You must first be convinced that it is an outstanding bargain.
- ✓ CHOOSE AS MANY OR AS FEW BOOKS AS YOU WISH. No minimum number of books required. Take only what you like.
- ✓ AUTOMATIC QUARTERLY SHIPMENT OF SELECTIONS. Books are automatically sent every three month (four new books a year) — no forms to fill out, nothing to forget.

**SCIENCE LIBRARY FOR ONLY 2¢ A DAY!**

Now! It's easy to have

# Beautiful Oak Floors

## PRE-finished
## Bruce Crestwood Flooring

Now you can have beautiful new oak floors in less than a day. Crestwood is a modern pre-finished flooring in a special size (2" wide by only ⅜" thick) designed to be laid over your old wood floor or subfloor. It's packaged in handy cartons complete with nails.

**Completely finished**—even waxed—at the factory, Crestwood requires no sanding or finishing. It's ready for use as soon as laid! Strips have tongues and grooves for blind nailing as shown in the photo above.

A new Bruce Crestwood Floor will cost you less than a good rug or carpet . . . and will last the life of your home. Sold by leading lumber dealers. Mail coupon for colorful literature.

**SEND FOR COLOR FOLDER**

E. L. BRUCE CO.
Box 397-CC, Memphis 1, Tenn.
Send literature on Bruce Crestwood Floors to:

Name_____

Address_____

**BRUCE CRESTWOOD FLOOR**
Product of world's largest hardwood flooring maker

### Auto Makers Answer Back on Safety

[Continued from page 94]

ment is warranted. There is a big, immediate need for public education—and in this field the industry is cooperating wholeheartedly through the National Safety Council, the Automotive Safety Foundation, the Cornell Crash Injury Research, and many other organizations.

*Panel padding.* Perhaps the author has discovered and merely failed to mention what *kind* of padding would make a real breakthrough contribution to safety. The industry has not, nor, to the best of our knowledge, has anyone else. Some kinds of padding do offer some improvement, and these are offered chiefly as optional equipment. A lot remains to be learned, however, before the best type or types are discovered and standardization is warranted.

*Outside mirror.* Often helpful, although its usefulness is frequently impaired by snow, rain, or dirt on the mirror surface. One problem weighing against standardization is a wide variance in driver preference for types of mirrors and their positioning. Many drivers simply object to any outside mirror.

*Collapsible steering mechanism.* This is and has been under study. Practical application is not as simple as the author indicates. For example, development of a "telescoping" column is seriously complicated by the wide range in driver weights. A design adequate to absorb the impact of a 200-pounder would react something like a brick wall to a 100-pound woman. Deeply recessed steering-wheel hubs have already provided at least some of the advantages claimed for collapsible steering columns.

*Headrests.* Protection from "whiplash" is desirable. Obtaining it without creating more serious problems is a problem in itself. For example, a seat back high enough to contribute much to reducing whiplash injuries would notably reduce the "see-through" ability which is now a great help to following drivers.

*Recessed knobs.* Progress here is continuing. However, in an attempt to reduce the likelihood of injury in the event of an accident, we cannot make it more difficult for the driver to reach and operate controls under normal driving conditions. To do so would only contribute to accident causes.



CONTINUED

# FIX IT FOR KEEPS

DU PONT **DUCO** ® HOUSEHOLD **CEMENT**

ALSO MENDS CHINA, METAL, PAPER, GLASS, LEATHER

**Loosens Rusted Bolts**
nuts, screws, "frozen" parts!

# LIQUID WRENCH®

**SUPER-PENETRANT**

The super-penetrating rust solvent that quickly loosens rust and corrosion.

AT ALL HARDWARE AND AUTO STORES

RADIATOR SPECIALTY COMPANY
CHARLOTTE, N. C.

SOLDER SEAL

# 6-IN-1 UNIMAT

ONLY MACHINE OF ITS KIND!

Compact workshop for all metal, plastic, wood. Precision lathe, milling machine, drill press, surface grinder, polishing/grinding machine, portable drill. Complete basic unit $129.50. **WRITE FOR FREE CATALOG.**

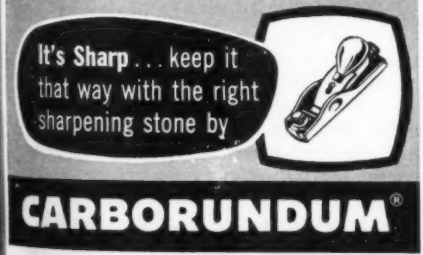
AMERICAN EDELSTAAL, INC., DEPT. HJ, 350 BROADWAY, N. Y. 13, N. Y.

# make your own Gems

36.50 F.O.B.

The Gem Maker comes complete with all necessary equipment, including a super-charged diamond blade for sawing, and all the wheels for grinding, shaping and polishing; also complete instructions. The complete equipment as shown, less motor and belt for only $36.50, f.o.b., Burlington, Wisconsin. Write today for information and literature.

**B&I MANUFACTURING CO.**
Dept. S, Burlington, Wis.




# palley's

SAVE UP TO 85% WITH GOV'T SURPLUS

## 100 TO 1 RATIO GEAR HEAD MOTOR

A real "workhorse" in a compact, rugged gear head motor. Gear ratio is 100 to 1 – gives the 24V., DC motor tremendous take-off power. Has clutch set at 375 ft. lbs. Take-off shaft is 1-1/16" dia. . . . . **24.50**

## NEW 85 TO 1 GEAR DRIVE

For use where tremendous power at low take-off speed is desired. Drives through a train of 6 gears that rotate on self-lubricating, high speed roller bearings. Take-off shafts are 1-1/4" and 3/8" in diameter. Overall size 6"x4"x2-1/2". Has a 180° offset drive. **No. GB-1112N 9.95**

## VICKERS HYDRAULIC TRANSMISSION TO DRIVE CONVEYORS LATHES DUPLICATORS SMALL CARS

No. H-VT-1SU

A 2 HP self-contained unit with constant torque at all speeds. Has variable volume reversible piston pump, controlled by outside lever and supplying a hydraulic motor. Input RPM is 1800 continuous or 4000 intermittent. No outside reservoir needed. Take-offs are female ½" dia., 11 spline. Power output RPM is 0 to 1/3 input RPM . . . **89.50**

**INPUT / TAKE-OFF Plate Assem.** To adapt above trans. to pulley, belt, gear or chain drive. Has high speed bearings and ½" keyway shafts. Per PAIR . . . . **20.00**

**DIRECT DRIVE 4" SHAFTS** – For above trans. Has 1/2" shaft for input and take-off on above. No. H-VT-PT – **2.50** PR.

## 3-SPEED TRANSMISSION

Converts a high speed low power input into low speed, high power take-off. Has 2 take-off shafts at 4 to 1 & 16 to 1 ratios. The gear box has bronze worm drive gears and throwout clutch. Will operate forward or reverse directions. Adaptable to many uses **19.95**

No. GB-1175U

## PRECISION 21 TO 1 SPEED REDUCER

Precision built for Army Gun Control mechanism. Gear ratio gives approx. 90 RPM with direct drive 1750 RPM motor. Can be belt driven with up to 1/10 HP motor. Has ball bearings throughout. Will operate conveyors, timing devices, etc. Many other gear drive bargains in stock. . . **14.75**

LEAR ELECTRIC 18 to 1 MIDGET HOIST

Use on boats, in shop, lab or to open garage doors. Reversible motor turns at 9000 RPM. Will run on 110V. AC with transformer (below) – normally uses 24V. DC. Has 18 to 1 gear box, magnetic clutch, limit switches.

Cost Gov't approx. $180 SAVE at only . . . . **5.75**

115 Volt TRANSFORMER . . . $3.45

## 5 TO 1 RATIO GEAR DRIVE ONLY 11.95

No. GB-126

High speed, low torque input is converted to slow speed, high torque output through direct gear drive. Input has a 20 tooth chain drive sprocket. Two outputs have 8 tooth chain sprockets. Gear ratio is 5 to 1. A Surplus Bargain

## ATTENTION HUNTERS! NEW HANDY HOIST

The strongest hoist for its weight on the market. A perfect GAME HOIST. Consists of two pulley blocks, 100 ft. of Nylon line, 2 Nylon slings, and canvas carrying case. Will hoist, pull, lift or drag heavy objects. Carry in the car for emergencies.

No. WH-HH1 lifts 1000 lbs. . . . **12.95**

No. WH-HH2 lifts 3000 lbs. . . . **19.95**

## 10 TO 1 GEAR BOX SPECIAL 9.95

A right angle drive through a 10 to 1 gear ratio. 4" diameter input shaft has chain drive to a 2", 14-tooth beveled gear power output. Overall lgth. is 12-1/2". Cat. No. GB-123

## 8x ELBOW SCOPE

Has a 2" objective lens, a Kellner eyepiece and an Amici erecting prism. The cross hair reticle is illuminated. Has 3 built-in light filters. Field – 325 ft. at 1000 yds. **9.88**

## SPECIAL PRECISION GEARED GOVT SURPLUS SERVO MOTOR 8.88

COST GOV'T $1500.00

Originally part of Norden Bomb Sight. Has Solenoids which operate the precision reversing gears. Gear reduction is 165 to 1. Operates on 24 to 28 V. DC. Can be used where extreme sensitivity and instant forward & reversing operations are required or use for parts.

## NEW 196 PG. CATALOG

JUST OFF THE PRESS WORLD'S MOST SOUGHT AFTER CATALOG!

NATIONALLY ADVERTISED MERCHANDISE • NEW and USED GOV'T. SURPLUS • FACTORY CLOSE-OUTS

Packed with thousands of bargains in Machinery, Hydraulic Cylinders, Pumps, Valves, etc. Tools, Aircraft Instruments & Hardware, Hobby Motors & Tools, Clothing, Camp. Equip., Optical Insts., etc. plus hundreds of other catagories. Send 50¢ for handling and mailing – TODAY!

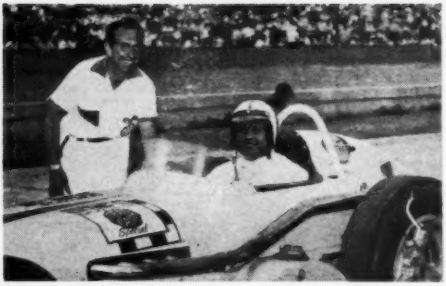
## NEW SURPLUS GYRO Only 10.95

Turns to 50,000 RPM. Electric motor drive is integral with balance wheel which is ball bearing mounted. Will operate on 24 Volt, DC-AC current. Ideal for hobbyist, science lab or experimental work.

**TO ORDER:** Send check or M.O. ½ dep. with C.O.D.'s. All items sent freight or postage collect.

palley's

2263 E VERNON AVE., DEPT. PS-101
LOS ANGELES 58, CALIFORNIA



*at the Indianapolis "500"*

**PROTO TOOLS HELPED "A. J." – AND GEORGE–TO THEIR 139.130 MPH RECORD**

You know the winning driver, A. J. Foyt. Now meet his winning chief mechanic, George Bignotti. George, like all the other "500" mechanics, uses and endorses Proto Tools—official hand tools for the race. This same tool quality is yours at your local Proto dealer. See him for PROTO dependability when you, too, need fine tools.

PROTO TOOLS
PROFESSIONAL QUALITY TOOLS

OFFICIAL TOOLS
INDIANAPOLIS "500"

2203 Santa Fe Ave., Los Angeles 54, California • 503 Allen Street, Jamestown, New York
1703 Oxford East, London, Ontario, Canada

*Take the "rub" out of refinishing*

**peel paint off**
WITH
**KLEAN-STRIP PAINT REMOVER**

• Fast • Clean • Non-inflammable
• One application removes many coats

**THE KLEAN-STRIP CO., INC.**
Memphis 6, Tenn.—Winnipeg, Man.

You have a use for
**KRYLON** ®
**SPRAY PAINT**
In Ready-to-Use Aerosol

IF YOU PRIZE IT...KRYLON-IZE IT!

**Fill Cracks And Holes Better**

Handles like putty. Hardens like wood.

**PLASTIC WOOD** ®

The *Genuine* – Accept No Substitute.

### Auto Makers Answer Back on Safety

*Stronger roof.* Among today's standard proving-ground tests of new body designs is the deliberate high-speed rollover. Such tests have been repeatedly witnessed by governors, legislators, motor-vehicle administrators, and others concerned with highway safety. The manufacturers have thousands of feet of film on which to study the deformation characteristics revealed by this violent testing. Both the witnesses and the objective evidence agree that the asserted need for such things as the "rollover cage" the author mentioned is grossly exaggerated.

*Clear road view.* It is difficult to understand how the great advances in this direction since World War II could have been so studiously ignored. Suffice it to say that such advances have been made and that they will continue.

*Better lighting.* The same basic comment applies here. Revolutionary advances in lighting have characterized the history of the industry. Improved lighting provides one of the greatest evidences of vehicle-safety progress, and further gains may be expected from research-and-development programs already under way.

*Responsive control.* Let's take another brief look at the Secretary of Commerce's report to Congress: "In a review of what we know about the vehicle in relation to safety, it would be an oversight to neglect the structural advancements which, though in part hidden, have brought increasingly greater inherent safety to the vehicle. These include but are surely not limited to the sturdiness features of frame and body construction. They encompass the improvements in steering geometry and suspension that lend stability to vehicle handling and ease of maneuverability."

11 "But the clinching argument for crashproofing the car is absolute necessity. Accidents are inevitable."

This attitude is defeatist, unrealistic, and diverts attention from productive measures to reduce accidents through better roads and better driving. There is no question that some accidents will still occur no matter what, but this is no excuse for giving up on already proven ways of reducing them. Crash-injury reduction is desirable and important, but

 CONTINUED

# READY CUT HOMES

**$2295 AND UP DIRECT FROM MILL**

**YOU SAVE** the items which help make today's building cost expensive: high labor cost, contractor's profit and overhead, insurance, architect's fees. Cut-to-Fit eliminates usual lumber and material waste, also costly mistakes. Anyone can assemble. Simple, easy-to-follow plans furnished and each part numbered. Complete with all lumber, roofing, nails, glass, hardware, paint, doors, windows. Freight paid. Low-cost building plans sold separately if desired. 57 Homes and Floor Plans.

**5 EASY PAY PLANS**
**COLOR CATALOG**
*Send* 25¢

**INTERNATIONAL MILL & TIMBER CO.**
Dept. PS101 Bay City, Mich.

# ELECTRIC WELD - BRAZE & CUT

**REPAIR MOST EVERYTHING MADE OF METAL**

Home appliances, Auto, Farm-garden equipment. Make and repair lawn chairs, tables, ornamental iron work, gates wagons, etc. Solder, heat, bend, and straighten, with terrific heat from arc torch. Cut and weld up to ½" steel plate. A million uses for Home, auto, farm, inventories, factories, etc. Works from any home 110 volt plug-in. Complete with dark welder's mask, arc torch, supply of carbon, welding and brazing rods and complete Welding Instruction Book. 1 year guarantee.

**Send only $3.00** (cash, ck, mo) and pay postman $11.95 plus COD postage on arrival or send $14.95 and we will send postpaid. Ideal gift. Available only from:

**MIDWAY WELDER Dept. DPS-10 Kearney, Nebraska**

# BUILD YOUR OWN POWER TOOLS

10" TILT/ARBOR SAW, COMB. DRILL-PRESS LATHE, 12" & 18" BANDSAWS, 6" BELT SANDER, SPINDLE SHAPER. Build easily with hand tools.

**FREE CATALOG!**

**GILLIOM POWER TOOLS MFG. CO.**
St. Charles 18, Missouri

**SPECIAL! PLANS—PATTERNS 50¢ EACH**
Enclose this Ad REFUNDABLE

# SAVE MONEY! MAKE MONEY! WITH PORTABLE CEMENT MIXER!

It's easy, fast, fun to do your own work with the MIXAL Mixer. Build barbecues, patios, sidewalks for yourself, for others! Mixes 3' x 8' sidewalk every hour! Uses any ¼ HP motor. Thousands used by contractors! Try it on MONEYBACK GUARANTEE! Send for FREE HOW-TO-DO-IT CEMENT MIXING BOOKLET. Dept. PS-10

**$29.95** pp without motor (add $3 W. of Rockies)

**KOL, INC., 2323 Ellis Ave., St. Paul, Minn.**

**EVERLITE®** (Item 869-10T)

# World's THRIFTIEST Light Plants

1000 watt amazing new alternator. Most efficient trouble-free light plant ever made. Rugged new transistor circuit eliminates commutator and armature—all the old headaches of generators gone. Output is standard current—115 v., AC—operate oil burner, freezer, lights, TV, power tools or anything that requires up to 1000 watts. Powered by sturdy, fast starting 2½ hp Clinton engine guar. for 1 full year. Price is unbelievable, only $149.50 F.O.B. factory for the finest 1000 w. plant made.

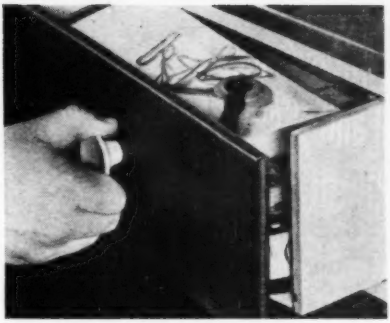
®Trade-Mark Registered

Everlite 1000 watt, Item 869-10T Wt. 60 lbs. ..... **$149.50**
Everlite 1500 watt, with 3 hp Briggs-Stratton engine ..... **$209.50**

ELECTRONIC BRAIN Now Available On All Our Plants—Write

**MASTER MECHANIC MFG. CO., Dept. B-101 Burlington, Wis.**

Southern Customers Order from Dept. B-101, Box 65, Sarasota, Fla.



# don't say "darn"...say DURATITE

**Best White Glue you can buy!**

Ask for DURATITE WHITE GLUE to solve mending problems like this in a hurry. Dries fast. Makes a tough bond as strong or stronger than the materials you repair. Mends so many different materials so easily you'll want two big plastic bottles . . . one for household, one for workshop. Get other DURATITE products, too — Wood and Metal Fillers, Household Cement, many more—at hardware, paint and building supply stores. Write for free DURATITE folders.

Say DURATITE for the best in Glues, Cements, Wood and Metal Fillers . . . say DAP for fine Caulking-Glazing-Sealing-Spackling products.

**DURATITE, A Division of DAP inc.**
**Dept. 45, Dayton 31, Ohio**

✶ DRY SOFT
✶ STAY SOFT
✶ WEAR LONGER
✶ LEATHER

*where better work gloves are sold*

**WOLVERINE GLOVES**

Speedy Sprayer

Do it yourself and pay for a Speedy Sprayer from the savings on the first paint job! Sprays fences, screens, shutters, furniture, rough walls, floors, big jobs in minutes instead of hours. Finish is smooth, flawless. A real professional tool, proved by 40 year's use. Get a Speedy Sprayer!

**W. R. BROWN CORP.**
*Our 40th Year of Portable Paint Sprayers*
2637 N. Normandy Ave., Chicago 35, Ill.

FREE! Write for "How to Spray" and catalog.

**SAVE MONEY ON WOOD**
POWER TOOLS
WORKSHOP SUPPLIES

NEW 140 PAGE CATALOG
Send Today!

**World's Largest Selection, Rare, Fancy and Imported Woods, Mosaic Tile, Lamp and Upholstery Supplies, Tools and Hardware! *All at Money Saving Prices!***

Send for this complete new wood buying guide and project book. Craftsman is your best, most complete source of finest kiln-dried domestic and rare imported woods, beautiful wood inlays, colorful bandings, matched plywoods, furniture legs, embossed mouldings, carved ornaments, newest wood-working tools, "hard to find" cabinet hardware and fittings... more than 1,500 items! Packed with new patterns, project ideas and money making plans. Enclose 25c to help pay mailing and handling cost. Write:

**CRAFTSMAN WOOD SERVICE CO.**
2729 S. Mary St., Dept. B-10, Chicago 8, Ill.

FREE CATALOG!

**TREMENDOUS SAVINGS ON HUNDREDS OF SURPLUS AND NEWLY MANUFACTURED ITEMS!**

New 1961 edition contains over 50 pages of tools and equipment for farm, home, workshop, factory. Hydraulic equipment, pumps, motors, construction and diesel equipment and parts! Write for your FREE CATALOG Today

**GROBAN SUPPLY COMPANY**
1139 South Wabash Ave., Dept F-10, Chicago 5, Ill., WEbster 9-3793

**The 'All-Purpose' Oil For Home Workshops**
Cleans • Lubricates • Prevents Rust
**3-IN-ONE® OIL**
REGULAR—OIL SPRAY—ELECTRIC MOTOR


***Auto Makers Answer Back on Safety***

no panacea. The best protection comes from avoiding the accident, and this can be achieved to a far greater extent by extended application of proved measures of prevention. For instance, with national fatality rates running well over 5 per 100 million vehicle miles in a recent year, the New York Thruway compiled a record of 0.88. Records not much higher than that were turned in on other long stretches of modern limited-access highway. Improvements in vehicle design can be and will be made as our knowledge increases, but let's not lull ourselves into thinking that any such spectacular gains are going to come from this direction.

12 "Today's best door lock reduces accidental openings by only half. Surely American engineering talent can do better than that."

It surely can and it surely will, but knowledge comes by working for it, not by wishing—that's why we're working.

13 "They knew how to make 'em safe (in 1937) . . . but that was 24 years ago. Look what's happened now."

The recessing of certain controls on a 1937 car hardly justifies the assertion that cars of that era had safer front seat compartments. Such recessing did not apply, either, to accessory items like radios and heaters. The steering-wheel hub was not recessed. We expect further improvement, yet today's front seat compartments are a vast improvement already over those of the mid-Thirties. Using this statement to imply that today's cars are less safe than those of nearly a quarter-century ago won't stand up even when considered alone, let alone when ranged alongside all the multitude of other safety advances.

14 "Most of all, why do we continue to tolerate those chromium-plated (control-panel) stilettos so malevolently aimed at the heart, brain, and legs?"

This paragraph seems typical of the exaggerated criticism of last month's article. It suggests a deliberate "malevolent" disregard for safety—ignoring any and all progress made and the ever-present need to balance crash safety with normal operating safety by making sure that all controls are first of all functional, within the limited area available for their installation.

***Auto Makers Answer Back on Safety***

**15** "Not all cars have windshield washers."

Windshield washers are available to all car owners at small cost. They are already standard in several states, where local officials believe that climatic conditions require their use.

**16** "Today's inside rear-view mirror helps your wife get her lipstick on straight, but not much else. And the outside mirror—without which no savvy truck or bus driver would even start his engine—is an optional extra on most passenger cars."

Today's mirror is highly effective—when drivers use it. There are limited blind spots to the rear, but eliminating them raises problems of interfering with forward vision. The outside mirror can be a definite aid, though for obvious reasons it is not as essential on a car as on trucks and buses.

**17** "Safety devices cost money; they raise the price of cars at least a little—and in an intensely competitive business that endangers sales. Detroit is also convinced that 'public acceptance' is usually adverse, that a safety pitch scares customers away."

There is no foundation for the charge that possible adverse sales effects prevent adoption of important safety features. Every new annual model contains safety advances, some of which raise costs to the manufacturer but not to the customer. The cost factor *is* one reason for offering some safety items—in the "desirable but not essential" category—as optional equipment. This gives the customer the privilege of deciding how much he wants to invest in *added* safety beyond the high degree of inherent safety built into every car as "standard equipment," just as he has the same options on added comfort, convenience, performance, and appearance. Industry attitudes on the merits of using "a safety pitch" in advertising have nothing to do with engineering safety into the car. The safety theme is not dominant in car advertising simply because experience has shown that it is not a highly persuasive sales approach.

**18** "You can't expect Detroit to move on safety without sharp prodding."

Here is a highly incomplete list of safety advances made *voluntarily* by

CONTINUED


# What the "oil-burning" engine is telling you

No mechanical part will last forever. By the time you have driven your car 50,000 miles, the crankshaft in your engine will have made 150,000,000 revolutions. Piston rings will show signs of wear. Engine bearings will wear, too, and your engine may begin to burn increasing amounts of oil.

**Worn bearings—sluggish performance**

Main, connecting rod, and camshaft bearings control the oil flow inside your engine. As bearings wear, they leak excessive amounts of oil, and this oil—up to 25 times the normal amount—is thrown violently against the cylinder walls. It slips past piston rings into the combustion chamber where it burns to heavy carbon and varnish. Rings become clogged and deposits build up on valves. Your car burns oil, gas mileage drops, and performance becomes sluggish.

**Fm bearings—1st choice for cars**

Your mechanic knows what to do. He'll probably recommend an overhaul . . . and new Federal-Mogul engine bearings. Fm bearings are used as original equipment by most American car and truck manufacturers.

Whether you drive an American car or an import, be completely satisfied—ask for Federal-Mogul bearings when you need an overhaul.

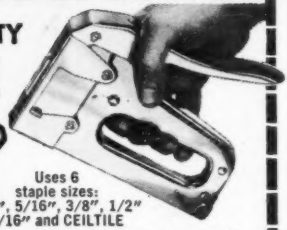
**FEDERAL-MOGUL SERVICE**

BEARING FEDERAL Mogul SERVICE

Division of Federal-Mogul-Bower Bearings, Inc. • Detroit 13, Michigan

**20 WAYS To Use An ARROW T-50**

HEAVY DUTY **STAPLE GUN**



Only $12.50

Uses 6 staple sizes: 1/4", 5/16", 3/8", 1/2" 9/16" and CEILTILE

- Install ceiling tile
- Install insulation
- Weatherstrip doors and windows
- Reupholster furniture
- Staple wire fencing to posts
- Repair window and door screens
- Fix loose wiring to floors, walls
- Replace worn window shades
- Tack down carpets
- Lay new linoleum
- Attach vines to trellis
- Affix plywood panels to walls
- Wrap and staple young tree trunks
- Line kitchen and closet shelves
- Hang drapes and curtains
- Make decorative cornices
- Cover valences with material
- Put up Christmas decorations
- Staple down building felt
- Quickly repair odd wood-working jobs

**ALSO No. JT-21 Junior TACKER For Light Duty Tacking Chores** $4.95

**ARROW FASTENER CO., INC.** 1 Junius St., Brooklyn, N.Y.

At Hardware, Building, Lumber and Stationery Dealers Everywhere.

**CUT THIS OUT AS A HANDY CHECK LIST**



**STEP UP to BENJAMIN'S** TRADITIONAL EXCELLENCE!

**DISCOVER the BIG DIFFERENCE that EXPERT CRAFTSMANSHIP can Make in Your SHOOTING PERFORMANCE and FUN!**

World Famous AIR GUNS and $CO_2$ GUNS

25 MODELS — SINGLE SHOT and REPEATERS — FIRST CHOICE of SHOOTERS who want SAFETY—CONVENIENCE — ECONOMY including HIGHEST QUALITY MATERIALS to Assure Them OUTSTANDING POWER — ACCURACY — DEPENDABILITY!

No. 3600 $19.95

No. 2600

No. 2600 BENJAMIN Super 35-Shot BB Gas Pistol. Safe—No Pumping—Uniform Hi-Power. For Target & Small Game. $18.95

No. 2620 BENJAMIN 20-Shot Cal. 22 Gas Pistol. Economical. $20.95

No. 1300 50-Shot BB Air Pistol $23.50

No. 1320 BENJAMIN 35-Shot Cal. 22 Air Pistol $25.50

No. 3600 BENJAMIN Super 100 Shot BB Gas Rifle. NonToxic — Safe — Convenient — Uniform Hi-Velocity Power.

No. 3620 BENJAMIN Super 85 Shot Cal. 22 Gas Rifle .... $21.95

No. 3100 Super 100 Shot BB Air Rifle. Adj. Shooting Force $24.95

No. 3120 BENJAMIN Super 85 Shot Cal. 22 Air Rifle .... $26.95

**FREE** Catalog All Models Benjamin Single Shot & Repeaters—Cal. BB or 177 or 22. Also, Special Hunting & Fishing Knife Offer.

**BENJAMIN AIR RIFLE CO., 852 MARION ST., ST. LOUIS 4, MO.**

**You Can DEPEND on... BENJAMIN**

**4-WAY WELDER** $14.95 Complete

WELD - BRAZE - SOLDER - CUT

**NO OTHER WELDER AT THIS PRICE** Complete with **SAFETY FOOT SWITCH, FULL FACE SHIELD,** twin carbon arc torch, welding rod holder, clamp, carbons, welding & brazing rods, flux, fuses, instruction book. **FULL YEAR GUARANTEE.** More than a quarter million in use in homes, garages, farms, shops, factories. **NOW** anyone can weld, braze, solder, cut, heat, without experience. Does 1001 jobs on all metals. Save & earn money. Make & repair auto bodies, parts, fenders, trailers, boats, metal furniture, fixtures, ornamental iron, farm equipment, garden tools, bicycles, toys, etc. Operate on any properly wired 110 V AC line. **SEND ONLY $2.** Pay postman $12.95 plus C.O.D. charges. Ideal lifetime gift for hobbyist, mechanic, hot rodder, homeowner. Order on 10-day money-back guarantee.

**FOUR WAY WELDER CO.** DEPT. FS-K, 1810S. FEDERAL ST. CHICAGO 16, ILL.


***Auto Makers Answer Back on Safety***

members of the auto industry during the past six decades:

1900-10: Steering wheels, kerosene lamps, speedometers, shock absorbers, carbide-gas lamps (replacing kerosene), tire chains, bumpers, electric headlamps (replacing carbide) and dash lamps.

1911-20: Electric starters, rear-view mirrors, all-steel open bodies, tilt-beam headlamps with prism lenses, stop lamps.

1921-30: Hydraulic brakes, adjustable front seats, four-wheel brakes, low-pressure tires, depressible fixed-focus headlamps, defrosters, safety glass, foot-controlled dimmer switches.

1931-40: Inside sun visors, reflex-lensed tail lamps, all-steel bodies with all-steel tops, steering-column gear shifts, Sealed Beam headlamps, turn indicators.

1941-50: Power steering, wrap-around rear windows, enlarged braking surfaces.

1951-60: Back-up lights, windshield washers, heat-absorbing and glare-resistant glass, automatic headlamp beam control, improved headlamp beam indicator, power brakes, improved door locks, panel padding. And a host of other safety improvements, including continuing improvement in instrument panels, ease of operation, field of vision, road stability, engine performance, and tires.

The recitation could continue because the story is a long one—but we hope that we have made one basic point clear:

The members of the automobile industry are responsible citizens, working hard to make a consistently better and safer product, but they do not believe that simply turning the whole problem of highway safety over to the federal government will materially reduce either the number or the severity of highway accidents. Only continued hard work on every reasonable front—including vehicle design—will produce solid and lasting results. ■ ■

---

▶▶▶THE second time I had to replace the rusted-out water pan in my furnace, I decided I'd wasted enough money. I removed the rust on the third pan and painted the inside with a rust preventive. When it was dry, I lined the pan carefully with heavy aluminum foil. It works fine.—*R. A. Gillaspy, St. Louis, Mo.*

New standard for power and torque in a compact grinder!

# NEW DREMEL NO. 3 INDUSTRIAL MOTO-TOOL

This new industrial type grinder belongs on your workbench! The No. 3 is a compact "powerhouse" developing 27,000 rpm — and sustains high torque under load. It's easy to handle (fits your hand), runs cool, lightweight. Weighs only 17 oz.! Just the ticket for precision grinding, polishing, drilling, sharpening, modelmaking — working in tight corners. Powerful 110 Volt AC or DC motor is housed in a heavy-duty, shockproof Bakelite case. Handy hanger hook keeps it within reach.

**No. 3 Moto-Tool** is complete with 1/8" and 3/32" collets, 3-wire grounding cord with 2-prong adapter, finger grip — in steel case. **Only $29.95.**

**No. 2 Moto-Tool** — long time favorite with industry, craftsmen, model makers since 1936 —

**No. 2 Moto-Tool** with 3-wire grounding cord, **$19.95.**

**No. 2 Moto-Tool** with 23 accessories in steel case, **$29.95.**

**See Your Dealer or Write for Complete Power Tool Catalog**

**DREMEL MFG. CO.,** Dept. 121-J, Racine, Wisconsin

150

# Cleaned

*good as new with*

**IMPERIAL**

**BRUSH CLEANER**

Brushes caked with hard paint are cleaned in minutes with Imperial. Leaves bristles glossy and springy—perfect for painting. At paint and hardware stores.

● **Send 25¢ for illustrated Refinishing Manual**

Write for free folder "Care of Paint Brushes"

Wilson-Imperial Co., 121 Chestnut St., Newark 5, N. J.

# FREE from RADIO SHACK

**America's most complete, exciting ELECTRONICS CATALOG**

PLUS all other issues for a full year!

Latest giant book is ⅔ bigger! 336 pages! Stereo, Hi-Fi, Ham Radio, Tapes, Records, Parts. 30 pages of fascinating Kits! No Money Down credit terms. Satisfaction guaranteed.

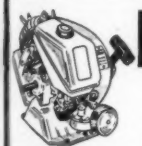
MAIL Coupon TODAY →

RADIO SHACK Corp. Dept. 61K4C
730 Commonwealth Ave., Boston 17, Mass.
Send me Radio Shack's famous electronics catalogs for 1-full year—all FREE and POSTPAID.

Name_____

Address_____

City_____ Zone_____ State_____



## Brand New 2½ hp Gas Engine Sale!

**Regular price $49.50**

**30 day Sale**

**$29.95**

**1 year factory warranty free service**

Unbelievable but true! Chance of a lifetime to buy a brand new Clinton Model A400 2½ hp Engine at nearly half price. Perfect for Go Carts — Scooters — Tractors — Mowers — Generators — Pumps, etc. Built-in throttle control and recoil starter—ready to go. We bailed out a manufacturer who needed cash—his loss is your gain—act fast! 1 for $29.95, 2 for $57.50, 6 for $149.99 (quantity limited)

**MASTER MECHANIC MFG. CO., Dept. B-101, Burlington, Wis.**

Southern Customers Order from Dept. B-101, Box 65, Sarasota, Florida

## The Modern PLASTIC for lasting Home Repairs

PERMANENTLY mends cracks or holes in wood, tile, stone or plaster. Sticks and stays put—Does not chip, shrink or fall out. Easy to use. Economical. Mold it, chisel it, polish or paint it. The big 4-lb. can is obtainable from your lumber, paint or hardware dealer at $1.40; or will be shipped direct postpaid (in U. S.) for $1.75. Complete satisfaction guaranteed or your money refunded. Order now.

**DONALD DURHAM CO.**

**Box 805-U Des Moines, Iowa**

## Print Your Own

Cards, Stationery, Advertising, Circulars, labels, photo and movie titles, church work, tags, etc. Save money. Sold direct from factory only. Raised printing like engraving, too.

**Own a Printing Business**

Print for Others, Good Profit. Have home shop. Junior press $15; Senior $35up. We supply everything. Easy rules. Pays for self in short time. Write now for free details.

**KELSEY PRESSES, Z-33 Meriden, Conn.**

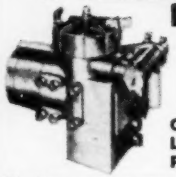
# Keep Tools in Tip-Top Condition

Lubricate · Clean · Prevent Rust

# 3-IN-ONE® OIL

REGULAR—OIL SPRAY—ELECTRIC MOTOR

**U. S. Gov. Surplus . . .**
**3 TERRIFIC BUYS!**
**PAINT SPRAY UNIT**



*Approximate cost $225.*
Our Low Price **$44.50**

Diaphragm compressor. Continuous operation, with 1/6 h.p. G.E. or W.H. motor, 110v. A.C. 1 qt. pressure type gun, round, fan and ceiling nozzles. Line filter, air dryer, air gauge, 10 ft. cord & plug, 20 ft. hose. Sprays paint, lacquer, enamel, insecticides, etc. Paint your auto, house, ANYTHING. Instructions furnished. Nothing else to buy. Wt. 66 lbs. Tire chuck FREE.

Fits in Car Trunk

**5-MAN Hexagonal—Pyramidal TENT**
U.S. Gov. price, $140. Our Price Only **$39.50**

6 sided, olive drab, inner liner. Insulates against heat & cold. Resists fire, water, mildew, weather. 13 x 13 ft., 8½ ft. high at peak. Wall ht. 2 ft. giving 6½ ft. pitch. 5 ft. zippered door. Stove pipe opening 2 screened air vents. Made of piled yarn, cotton sateen cloth. Includes carrying case with straps. Wt. 40 lbs.

**STAINLESS STEEL TANK—80 GAL.**

J-1, 24" x 48", 400 PSI. For air, water, chemicals. Rust & corrosion proof. ¼" pipe thread each end. Wt. 225 lbs. $400 value—$99.50.

F.O.B. CHICAGO. ORDER FROM THIS AD.
Money back guarantee. Send check or money order.

**ILLINOIS MFG. & SUPPLY CO.**
1829 S. State Dept. PS-10 Chicago 16, Ill.

**CLOGGED SEWERS**
FREE BOOK TELLS HOW
**REMEMBER THE COSTLY PLUMBING BILL**

Chicago—October 1. Just introduced is a Free Booklet on machines which enable the Home Owner, Janitor or Factory Maintenance Man to Rod-It-himself—

Yet anyone can operate this **new Rodding Tool** which is whirled down the drain in a few seconds. SINKS, BATHTUBS, TOILETS, URINALS, FLOOR DRAINS, HOUSE TO STREET SEWERS can be cleared of Rags, Grease, Paper, Sand while Cutter blades can be added for removing roots. A new discovery in Swedish Music Wire gives the roll 100% more Flexibility.

Another new unit is the Miller Electric Rodder which has patented cutters that expand automatically to the size of the pipe. It will clean out heavy obstructions in pipe diameters 3" to 12". Smaller Sizes available. But now, what are these Tools worth in **COSTLY PLUMBING BILLS SAVED.** Tear this Ad out—and write your name and address beside it for **FREE BOOKLET** on Hand and Electric Units. Obey that urge. No Agent will call. A postcard will do (Chicago Phone Kildare 5-1702)

Attachable Cutter Blades

FREE BOOK

**Miller Sewer Rod, Dept. PR-10, 4640 N. Central Ave., Chicago 30, Ill.**

*[Continued from page 81]*


4) a new stick shift without clutch pedal like that on the DKW; 5) the same thing with overdrive.

The American also has separate fluid reservoirs in the master cylinder—like Cadillac—for the front and rear brakes, plus a "poor-man's power seat." The seat is hydraulically raised and lowered by a hand pump at the side. It's only for the right front seat, though.

Much of the remainder of the engineering improvements in the new cars falls in the ho-hum category. Some samples:

- Dodge has an axial-flow blower, more powerful than the conventional kind, for heating and air-conditioning.
- General Motors cars have a new six-cylinder (instead of five) compressor for their air-conditioning systems. Olds and Buick are using alternators—pioneered by Chrysler—in place of generators on cars with air conditioners.
- Chrysler Corp. cars have a new aluminum-cased starter. More muscular, draws less current, doesn't whine.
- Valiant and Lancer have moved the lever on the stick shift from floor to steering column. More room for that middle passenger.
- Buick has shoved the engines in its standard cars four inches forward. Cuts down the tunnel height under the feet.
- Chrysler Corp. has a smaller automatic transmission, 60 pounds lighter.
- Also Chrysler: air-cooled distributor breaker points. They stay cleaner.
- Chevy has replaced its water-temperature gauge with an idiot light; Corvair has an automatic choke in place of manual. This, says Chevy, is progress.
- Tempest ducts more exhaust heat to its intake manifolding for faster warmups.
- Olds and Pontiac have shucked their wheel ball bearings for tapered rollers.
- Many of the suspensions, already soft as putty, are softer.

In conclusion, the Buick people may have a shock coming. In their engineering presentation for '62, they innocently specify that their cars were tested on the *rough* surfaces of New Orleans, Phoenix, and Los Angeles streets, and of New York's Henry Hudson Parkway and New Jersey's Turnpike and Garden State Parkway. There's a limit to the abuse that local pride can stand. ■ ■

dal
ing

nid
ike
es,
eat
y a
the

gi-
lls
es:
er,
nal
g.
ix-
sor
lds
io-
er-

m-
ar,

the
to
hat

its
uts

na-

tor

m-
or-
of
s.
to
ps.
eir
rs.
dy

ay
gi-
no-
ed
ns,
d
nd
ate
ns